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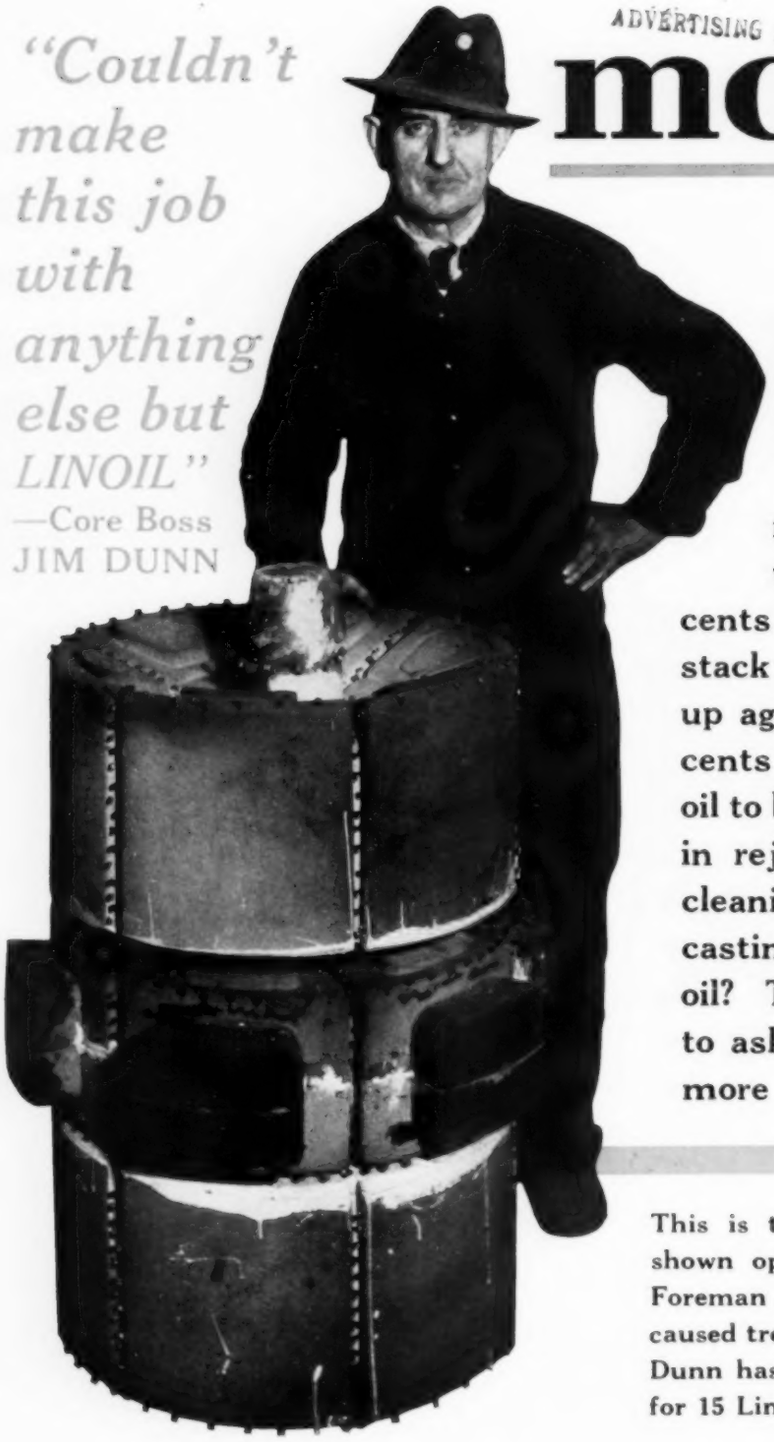
"Couldn't make this job with anything else but LINOIL"
—Core Boss
JIM DUNN



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more tons per drum of oil, that's what Linoil gives. How does a few cents lower price on a gallon of core oil stack up against that? How does it stack up against drying costs? At how many cents cheaper do you have to buy inferior oil to be ahead if there is a slight increase in reject castings? How much more cleaning room time can you pile on the casting and still be ahead with the cheap oil? These are the questions you've got to ask to get the real answer. There is more to Linoil than price and name.

This is the core for the double-tired truck wheel shown opposite. It is a tricky job to handle but Foreman James Dunn has not lost a one nor has one caused trouble in the foundry or in the cleaning room. Dunn has been in charge of the core room at West's for 15 Linoil-using years. He swears by Linoil.

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THE FOUNDRY

EDITORIAL

Specifications for Castings Should Be Co-Ordinated

NUMBER of specifications now in use for both ferrous and nonferrous castings is entirely too large for either efficient or economical operation in the uncertain period which lies ahead. In addition to castings standards of the American Society for Testing Materials, specifications for cast products have been developed and are in use by other engineering groups, federal agencies, companies and individual purchasers. This situation seriously complicates the problem of the foundryman. Undoubtedly the number of specifications could be reduced materially and still meet completely the needs of consumers of castings.

A movement toward the general simplification of specifications for a wide variety of engineering materials is well under way. Since the A. S. T. M. is engaged in this work, and the castings standards of that organization are used extensively by users of cast parts, the various committees on castings, including subcommittee VIII of committee A-1 on steel castings, committee A-3 on cast iron, committee A-7 on malleable iron, and committees B-5 and B-7 on nonferrous castings, should take the leadership in the movement toward simplification of specifications and should feel free to call on the industry for any assistance which may be necessary.

Reports indicate that work is in progress on committee B-5, covering both cast and wrought alloys, and that definite progress has been made both in simplification and co-ordination with government specifications. Undoubtedly, committee A-3 on cast iron would find it advantageous to attempt to secure closer co-ordination of all of the various iron specifications in use today with the master A. S. T. M. specification on general castings, A 48-36. While recognizing the necessity for special features and additional "service type" tests on some products, the basic tensile and transverse prescriptions could be referred directly to A 48. As an example, the A 126 specification for valves, flanges and pipe fittings calls for a different type test bar and different tensile ranges than A 48, although corresponding government specifications refer directly to A 48. Considerable correlation and clarification could be made in some of the specifications for steel castings.

In view of the confidence of industry in the A. S. T. M. as a representative consumer-producer group, it would seem a meeting of A. S. T. M. executives and committee chairmen with qualified governmental representatives would provide a sound preliminary step toward the formation of an advisory board and working groups which could render invaluable service in this emergency.

Safety Needs Attention

SAFETY record for foundries received a slight setback in 1939, according to an interesting survey of member companies recently published by the National Safety council. The 1939 frequency rate among foundries, which represents the number of reportable injuries per one million man hours of exposure, was 19.08, as compared with a frequency rate of 18.42 during the previous year. The severity rate, which is the number of days lost as a result of reportable injuries per one thousand man hours of exposure, was 1.43 in 1939 and 0.88 in 1938. While the report advances no reasons for the increases in both frequency and severity rates in 1939, an increase in the operating rate of foundries probably was a contributing factor. Results of the 1939 survey emphasize the need for increased attention to all phases of safety work as foundry operations continue to rise.

Frank G. Steinebach
Editor

Castings Must Pass Many Tests

By M. D. JOHNSON
Chief, Inspection Department
Caterpillar Tractor Co.
Peoria, Ill.

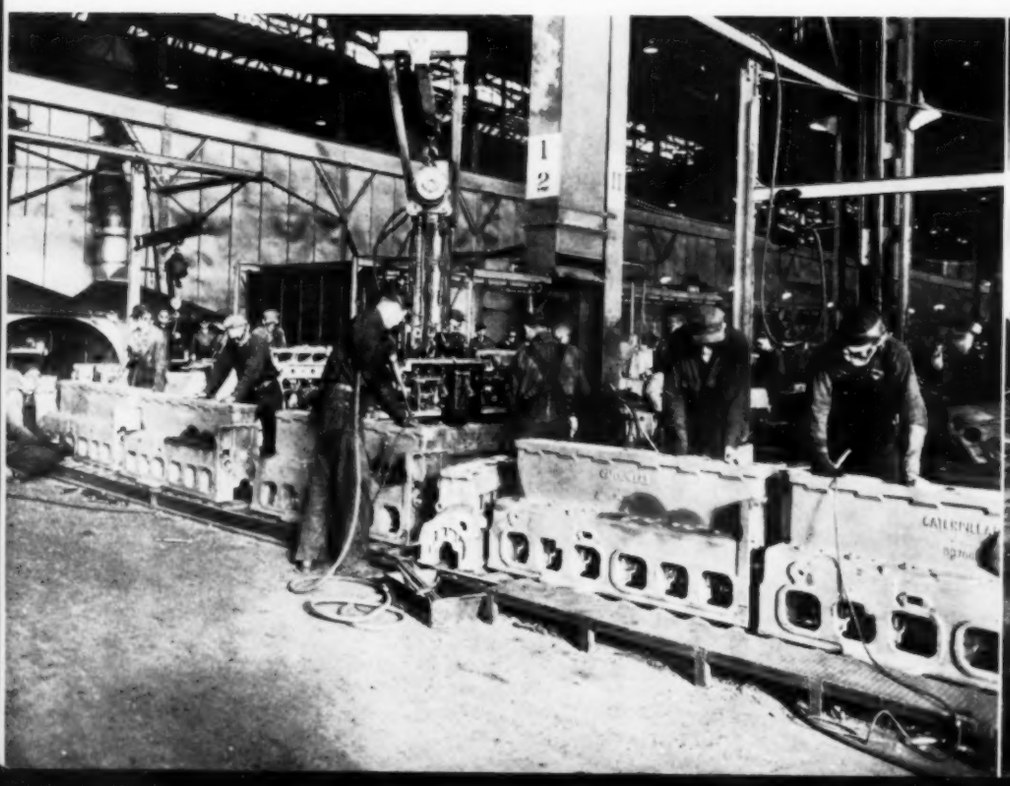
INSPECTION is the art of critical examination by standards of comparison, actual or theoretical for the purpose of judging the value of any part for use in its particular place. Inspection is not designed to see how much can be rejected, but to insure accuracy with a minimum of rejections.

The inspector serves as the eyes of the workmen, foremen, and superintendents, eyes used by the organization as a whole to detect materials which should not be used. The inspector should have good power of observation, patience, and tact. Observation is highly essential to quickly sense changes taking place that will lead to rejections if allowed to continue. Patience and tact will enable him to find the cause of rejections and also will help to maintain cordial relations with the production men.

The inspection department rightfully should be considered a service department. Like the service department of any manufacturing company, the inspection department safeguards the quality of the product.

An inspection program is maintained only at the strength the management policy desires. Without full management co-operation, inadequate inspection facilities, lack of co-ordination and support will be found. Inspection plays such an important part in the finished product, that a plant as a whole is weakened, if a conscientious inspection program is not in progress or is not supported by the management.

Every foundry should strive to strengthen inspection of castings, and to do this, the machine shop must be considered. Co-operation as close to 100 per cent as possible must be created between machine shop and foundry, and this is not always accomplished easily. A foundry may be



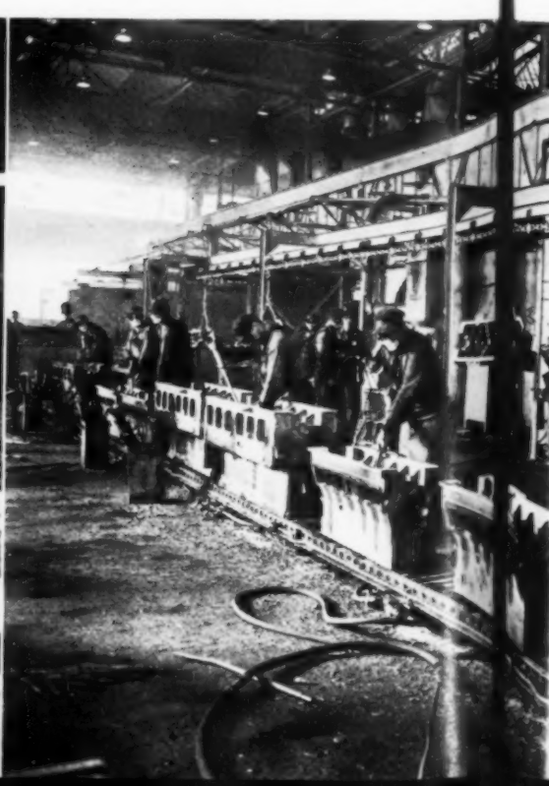
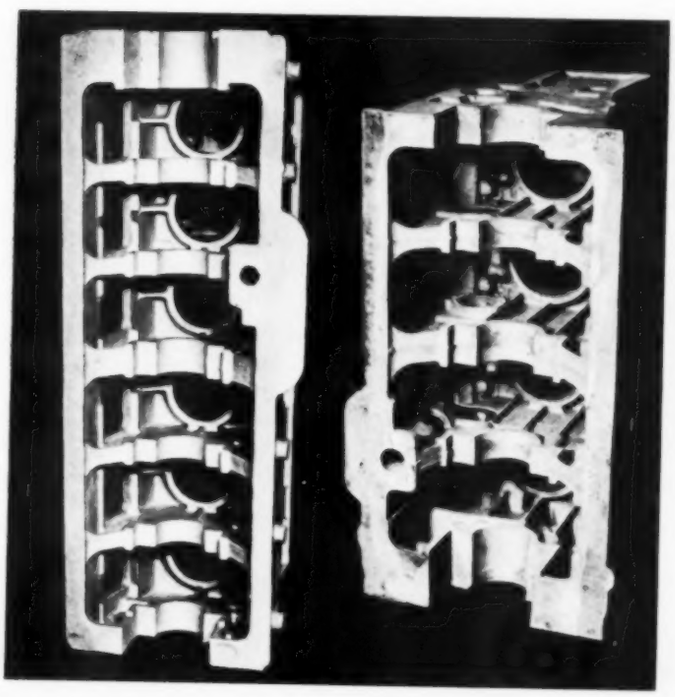
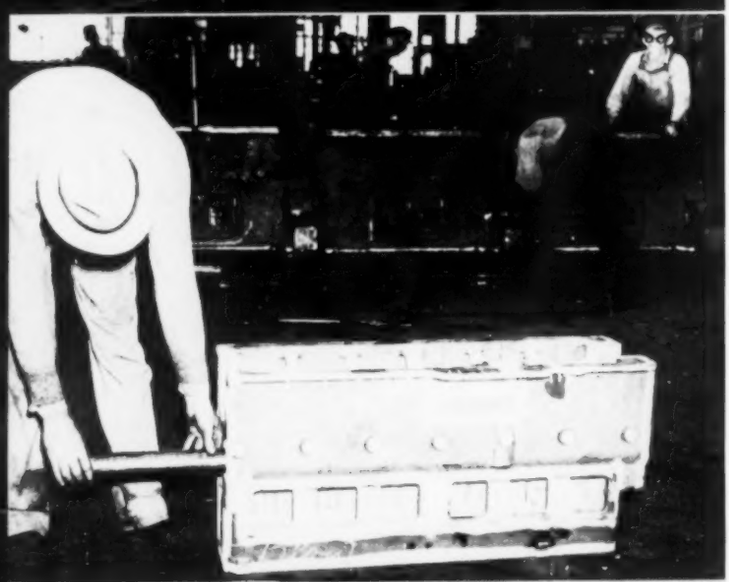


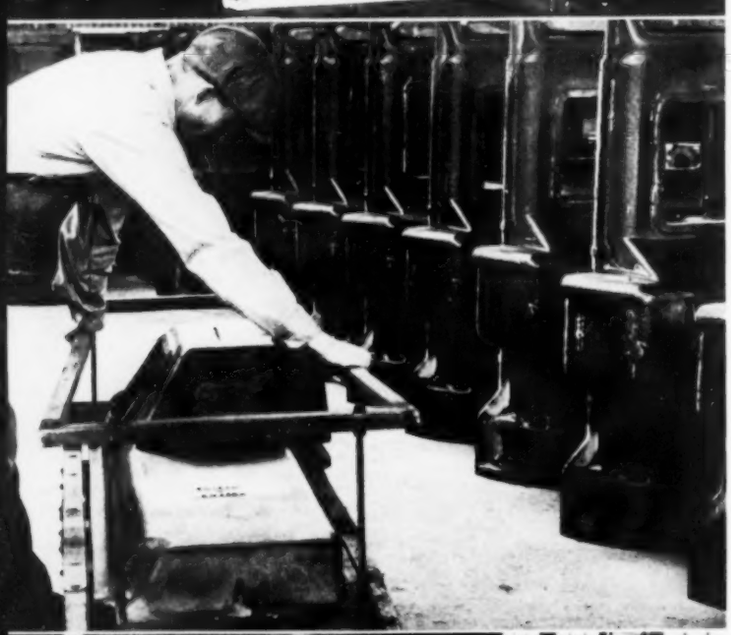
Fig. 1 (Right)—All lumber used for making patterns is checked with a moisture meter when unloaded to determine the moisture content. Fig. 2 and 3 (Below)—Visual inspection is all that is required to be assured that castings are being cleaned properly. It is easy to distinguish in these illustrations which is the clean and which is the improperly cleaned casting

Figs. 4, 5 and 6 (Bottom)—Progressive inspection in machine shops has led to the use of that same type of inspection in foundries. Where a foundry is laid out in definite lines, it is easy to be assured that castings taken off the end of the line are satisfactory for the intended use. These three illustrations show a foundry layout which is materially beneficial to inspection

All illustrations in this article were supplied through courtesy of the Caterpillar Tractor Co., Peoria, Ill.







in any one of at least three different positions: (1) Foundry and machine shop parts of the same organization and in close proximity. (2) Foundry and machine shop in different organizations, but location relatively close, in same or near by city. (3) Foundry and machine shop which either do or do not belong to same company, and are many miles apart.

The ideal relationship is where foundry and machine shop belong to the same organization and are located close to each other. This ideal relationship prevails in the Peoria plants of the Caterpillar Tractor Co. Although men are doing inspection work in the foundry, they are not termed foundry inspectors. They come directly under the jurisdiction and supervision of machine shop management. These inspectors are a part of the general inspection organization but assigned to do their work for the machine shop in the foundry.

Missing Defects May Cost Tonnage

Regardless of type a thorough inspection program materially affects the progress of a foundry. By allowing undesirable cast iron, malleable or steel castings to get through a foundry inspection, these castings often are redesigned as either forgings or welded structural steel sections. If a higher degree of inspection was demanded and supported from the various foundries, many more items would be left with the foundries.

Oftentimes those involved in judging a casting after careful and honest consideration may decide that a particular casting will serve its fundamental purpose and allow it to pass through all inspections and into the final product. In doing this how many ever think what might happen if this particular casting fails. Someone may get severely injured, or possibly killed, through the failure of a particular part.

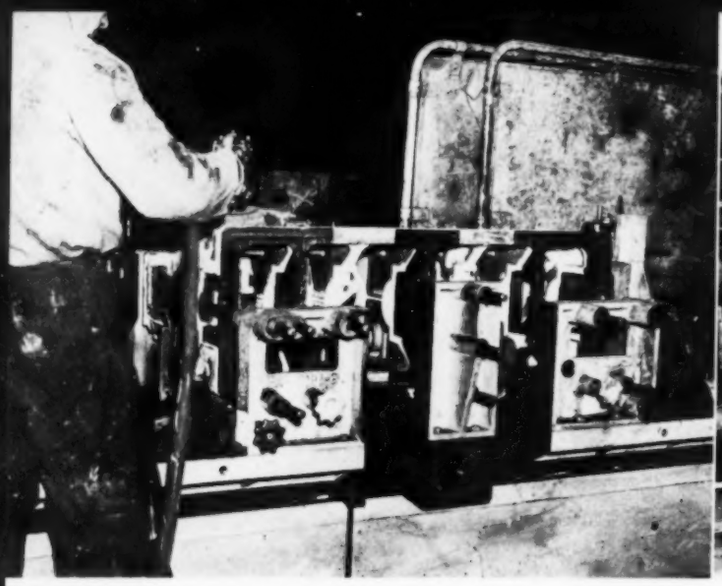
Figs. 7, 8, 9 and 10 (Left from Top to Bottom) and Fig. 11 (Below)—Casting inspection is not necessarily difficult. In fact, the largest number of defects in castings can be discovered through normal visual inspection, aided by relatively simple inspection equipment. These illustrations are typical of simple inspection equipment

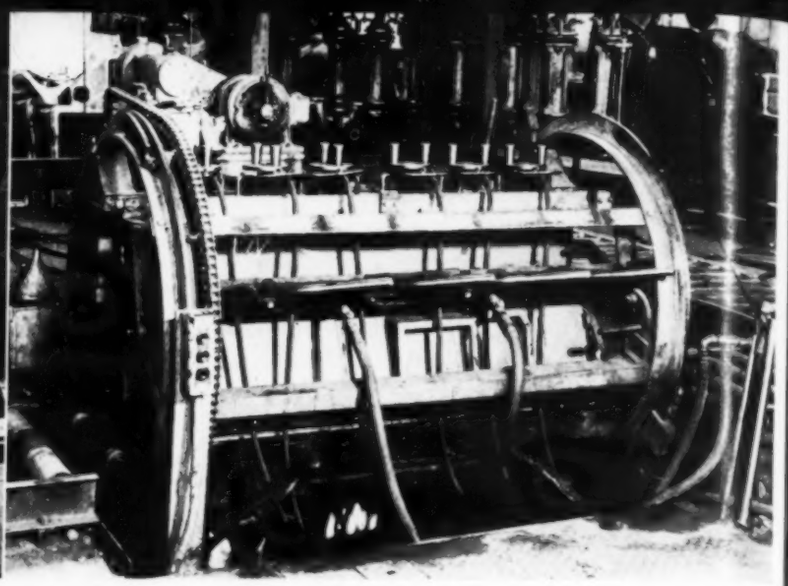
An inspection organization can render material service in the early stages of various manufacturing programs. For example, the inspection department can offer considerable help in the improvement of castings by taking an interest in the material used for making patterns. There is no reason why the equipment for checking shipments of production lumber cannot be made available for the inspection of pattern lumber. Assurance that the pattern lumber is right is a further safeguard of accurate castings.

Many angles center around the preliminary inspection of a casting, recognized as the proving of a pattern. This term covers a wider scope than the normal checking of sample castings. A casting may be made by the company making the pattern. A check may indicate that it is satisfactory in every detail. However, should the pattern be sent to another foundry, where different foundry conditions, sand mixtures, molding equipment, and even pouring facilities exist, a casting may not check identically with the previous casting. If this deviation is too great, it may be necessary to make certain changes on the pattern equipment to produce a casting in line with the original sample.

One point from the standpoint of inspection of castings should be stressed. Any change on a pattern should not be made by any foundry without the full knowledge and approval of the

Fig. 12 (Below)—Some items require close visual inspection. A crack may be observed in the center lever. Figs. 13 and 14 (Right)—Gas holes under the surface of a casting generally can be discovered by exploring the surface with an ordinary pointed hammer. Efficiency of this work may be improved by having inspectors use air hammers





Figs. 15 and 16 (Top)—Layout and grinding fixtures as well as water testing equipment are incorporated in production lines in some foundries and are used in conjunction with the cleaning and inspection of castings

Fig. 17 (Left)—Some casting defects, such as shrinks, cracks and sand holes, may be discovered by saturating one side with kerosine or a similar product and then inspecting the other side of the casting, as shown in the two larger illustrations. One of the first steps in determining the accuracy of castings is to prove the pattern by careful checking. As shown at the lower right in the illustration at the left, it often is necessary to cut up a casting to check the various internal sections for accuracy

Figs. 18 and 19 (Below)—To be assured of the same standard of inspection throughout the manufacturing plant it is necessary to have an exchange of ideas between plant inspectors. These illustrations show a group of machine shop inspectors starting on a tour of inspection in the foundry, and the method of explaining foundry equipment to the supervisory force

The slogan "Almost Right Is Wrong" which is shown on several of these pages, hangs in the chief inspector's office

company owning the pattern equipment and purchasing the castings. After the pattern has been proven and the casting made, after it has been given the stamp of approval by the buyer, it should not be necessary for additional proving of the pattern, unless there is indication of excessive wear, or changes are made in the design.

This does not mean that further inspection of castings is unnecessary. Inspection of the castings has just begun. Many other factors entering into the ultimate production castings must be watched for constantly by qualified inspectors. Some of the many errors and defects include: Cracks, cold shuts, shrinks, porous and loose iron, gas holes, sand holes, slag, dirt, strains, inaccurate locating points, core shifts, mismatches, hard spots, and chilled iron.

The type of inspection that must be stressed and developed most is that of visual inspection. An observing and competent inspector can detect almost instantly over 90 per cent of undesirable castings. For many defects, loose dirt, burnt-in-sand, exaggerated core shifts and mismatches, visual inspection is the only method necessary.

Segregated by Sounding Method

Many castings may be segregated as satisfactory or unsatisfactory by the sounding method of inspection. The casting is struck with a hammer. Difference in sound between a good and poor casting easily is detected by an experienced inspector. This method is used largely for locating cracks in certain types of castings; also to determine satisfactory and unsatisfactory metal. This type of inspection is particularly valuable for separating castings after a defect is known to exist.

One of the oldest and most severe tests, is known commonly as the chalk and oil method. The casting is saturated with kerosine oil or some suitable substitute. Excess oil is wiped off and chalk is placed on the casting. This chalk absorbent, draws the oil that is in the crack to darken the chalk at any particular place.

This method of inspection has some unfavorable features. Before painting it becomes necessary to remove the chalk and oil. As far as the oil is concerned, this unfavorable feature may be minimized by using some other solution with the oil. Outstanding among other ingredients is oleum spirits. Depending on the weather and atmospheric conditions, it is possible to use as high as 100 per cent kerosine in extremely hot and dry weather. In cold, damp weather, 100 per cent oleum spirits may be used. For intermediate conditions, varying percentages of kerosine and oleum spirits may be mixed.

In one popular method of inspection the castings are sprayed with a light coat of paint. A crack easily is seen after the casting has been painted. This particular method has a distinct advantage in that it eliminates the necessity of removing chalk and oil. The economic problem is to determine whether it is more practical to paint the casting, thus losing the cleaning and painting time, as well as the paint, or to resort to a 100 per cent chalk and oil test, discarding a few castings, but still having to remove the chalk and oil. Usually, the painting method is more practical and economical.

Magnetic Force Attracts Powder

The magnaflux has been used advantageously to locate cracks in castings. In this process a magnetic current is passed through the casting while a patented powder or solution is applied to the surface. This method is used more generally on finished surfaces where the solution is applied. For rough castings, the powder has been found more practical.

Putting castings through the Bullard-Dunn cleaning process often reveals blemishes and defects not brought to light by other cleaning methods. At present only a few of these machines are in use in conjunction with casting inspection. In the near future many foundries, especially those making smaller castings, probably will resort to this method as a final cleaning process, where the parts are put through successive baths of hot caustic, cold water, acid, cold and hot water.

For gas holes, shrinks, and hidden defects, it is often desirable to explore the surface with various tools. Most common of these tools is the ordinary pointed hammer, although men can be trained to use automatic or air hammer very efficiently. Caution must be observed in this type of inspection. Varying strengths of material, and varying wall thicknesses, may be in the process of examination. Enough pressure must be exerted to reveal the defect, yet (*Please turn to page* 108)

Distributing Overhead Costs By Production Centers

By ALBERT E. GROVER

FIRST objective of every jobbing foundry is a fair return on its investment in physical properties, personnel and other operating expenses necessary to convert the raw metal into shapes, sizes and structures suitable to the particular needs of the customer.

Various operations are necessary to this conversion, the most important of which is molding. This article deals with the analysis and consequent conclusions as to the importance of considering several methods of making molds in figuring the cost of different jobs.

Forms, accounts and figures in the several accompanying tables are used only for explanation of principles and methods and must not be considered as industry standards or bases for calculating selling prices of individual jobs. If a reader wishes to avail himself of the benefits of the principles and methods, or to further check the advisability of applying them in his own foundry, he should use facts determined from his own operations.

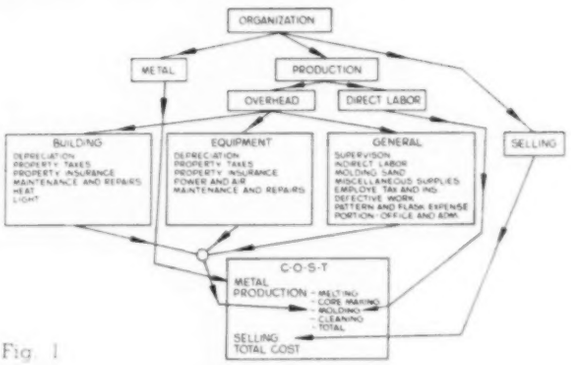


Fig. 1

Molding Overhead Falls into Classes

Molding cost consists of direct labor or wages paid for setting up the mold, and overhead expense, which includes other expenditures of cash and allowances for the wasting and use of physical assets caused by the molding operation.

Molding overhead cost falls into three classes, representing the bases of distribution necessary to state correctly the cost of molding individual patterns. These classes are as follows: *Buildings*, a place for the molds to be made; *Equipment*, tools to work with; *General* which includes supervision as well as supplies and other expenses caused by this operation. This is shown graphically in Fig. 1.

Building expense is first determined for the entire foundry, then allocated to the several departments, (representing operations) on the basis of floor area occupied by each. Table I is the molding department share of the total daily building expense. There being 22,500 square feet occupied by the molding department, the cost per square foot is 0.09 cents per day.

Many molding departments are equipped with different sizes of molding machines to be used in making molds for the various shapes and sizes of castings. These subdivisions of the molding department are hereafter called *Production Centers*. The different kinds of expenses caused by operating these machines has no consistent relationship with either molder's hours, molder's pay, or weight of castings produced, (commonly used bases for distributing overhead to jobs). Therefore accurate costs are predicated on determining the cost of operating the floors for hand ramming and the different sizes of machines. Line 5 of Table III marked *Total*, shows variations in daily operating costs for hand ramming, floors using small machines and those using heavier machines.

Overhead rates per hour shown on line 9 of Table III is determined by dividing total daily cost by daily normal hours shown on line 7.

Per cent of overhead shown on line 10 is determined by dividing total daily cost by daily normal pay shown on line 8.

Cost per hundred pounds is determined by dividing total daily cost by daily average production per molder. For example, 10 molders on the ten small machines (*Please turn to page* 98)

Table I

Building Expense

(One day)

Depreciation on Buildings	$ 8.52
Property Taxes and Insurance	3.17
Maintenance and Repairs	1.78
Heat (yearly basis)	1.73
Light (yearly basis)	4.80
	$20.00
Area—(square feet)	22,500
Daily cost per square foot	.09c

Table II

Crane Operating

(One day)

Operator	$ 4.80	
Overhead	5.50	
Total	$ 10.30	
Average Normal Hours	150	
Rate Per Hour	6.8c	
Average Normal Pay	$120	
Per Cent of Normal Pay	8.6	per cent
Average Production Per Man	634	pounds
Rate Per Hundred Pounds	6 c	
Lifts(assumed)	100	
Rate Per Lift	10c	

Table III

Equipment Expense

(One day)

	Total		Hand Ramming	10 Small Machines	2 $1000 Machines	2 $2000 Machines	2 $3000 Machines	2 $4000 Machines	2 $5000 Machines
Depreciation @ 7 Per Cent Per Annum	$ 8.40	(.056) *	$ .23	$ 1.17	$ .47	$ .93	$1.40	$1.87	$2.33
Property Taxes and Insurance	.84	(.006)	.02	.12	.05	.09	.14	.19	.23
Power and Air	9.00	(.060)	...	1.20	.52	1.02	1.54	2.06	2.66
Maintenance and Repairs	3.42	(.023)	.09	.48	.19	.37	.58	.77	.94
Total	$ 21.66		$ .34	$ 2.97	$1.23	$2.41	$3.66	$4.89	$6.16
Molders	25		5	10	2	2	2	2	2
Normal Hours 75 Per Cent Capacity	150		30	60	12	12	12	12	12
Normal Pay @ 80c Per Hour	$120.00		$24.00	$48.00	$9.60	$9.60	$9.60	$9.60	$9.60
Overhead Rate Per Hour	14c		1c	5c	10c	20c	31c	41c	51c
Per Cent of overhead to Normal Pay	18%		1%	6%	13%	25%	38%	51%	64%
Average Production Per Man (Pounds)	634		634	634	634	634	634	634	634
Cost Per Hundred Pounds	14c		1c	5c	10c	19c	29c	39c	49c

*Cost per hour.

Table IV

General Expense

(One day)

	Total		Hand Ramming	10 Small Machines	2 $1000 Machines	2 $2000 Machines	2 $3000 Machines	2 $4000 Machines	2 $5000 Machines
Supervision ($2000 Per Annum)	$ 6.67	(.044) *	$ 1.34	$ 2.68	$ .53	$ .53	$ .53	$ .53	$ .53
Indirect Labor	53.08	(.358)	10.61	21.22	4.25	4.25	4.25	4.25	4.25
Molding Sand	5.38	(.036)	1.08	2.15	.43	.43	.43	.43	.43
Miscellaneous Supplies	7.12	(.047)	1.42	2.85	.57	.57	.57	.57	.58
Employer Taxes and Insurance	12.00	(.080)	2.40	4.80	.96	.96	.96	.96	.96
Defective Works	2.76	(.018)	.56	1.10	.22	.22	.22	.22	.22
Pattern and Flask Expense	5.50	(.037)	1.10	2.20	.44	.44	.44	.44	.44
Portion of Office and Administration	28.50	(.190)	5.70	11.40	2.28	2.28	2.28	2.28	2.28
Total	$121.01		$24.21	$48.40	$9.68	$9.68	$9.68	$9.68	$9.68
Molders	25		5	10	2	2	2	2	2
Normal Hours 75 Per Cent Capacity	150		30	60	12	12	12	12	12
Normal Pay @ 80c Per Hour	$120.00		$24.00	$48.00	$9.60	$9.60	$9.60	$9.60	$9.60
Overhead Rate Per Hour	81c		81c	81c	81c	81c	81c	81c	81c
Per Cent Overhead to Normal Pay	101%		101%	101%	101%	101%	101%	101%	101%
Cost Per Hundred Pounds	76c		76c	76c	76c	76c	76c	76c	76c

*Cost per hour.

Table V

Total Overhead—Summary of Tables

(One day)

	Total		Hand Ramming	10 Small Machines	2 $1000 Machines	2 $2000 Machines	2 $3000 Machines	2 $4000 Machines	2 $5000 Machines
Building Expense (Table I)	$ 20.00	(.133) *	$ 4.00	$ 8.00	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 1.60
Equipment Expense (Table II)	21.66	(.144)	.34	2.97	1.23	2.41	3.66	4.89	6.16
General Expense (Table III)	121.01	(.806)	24.21	48.40	9.68	9.68	9.68	9.68	9.68
Crane Operating (Table IV)	10.30	(.069)	2.05	4.10	.83	.83	.83	.83	.83
Total	$172.97		$30.60	$63.47	$13.34	$14.52	$15.77	$17.00	$18.27
Molders	25		5	10	2	2	2	2	2
Normal Hours 75 Per Cent Capacity	150		30	60	12	12	12	12	12
Normal Pay @ 80c Per Hour	$120.00		$24.00	$48.00	$ 9.60	$ 9.60	$ 9.60	$ 9.60	$ 9.60
Overhead Rate Per Hour	$ 1.15		$ 1.02	$ 1.06	$ 1.11	$ 1.21	$ 1.31	$ 1.42	$ 1.52
Overhead Per Cent of Normal Pay	144%		128%	132%	139%	151%	164%	177%	190%
Average Production Per Man (Pounds)	634		634	634	634	634	634	634	634
Cost Per Hundred Pounds	$ 1.09		97c	$ 1.00	$ 1.06	$ 1.15	$ 1.25	$ 1.34	$ 1.44

*Cost per hour.

Glass Molds PRESENT MANY PROBLEMS

By ROBERT M. SCAFE

ACCORDING to Merica, "Progress in Improvement of Cast Iron and Use of Alloys in Iron," *Transactions*, A.I.M.E., vol. 125, 1937, alloys may be classified in relation to their effect on cast iron as chill restraining or accelerating in varied degree; their effect on carbides at high temperatures by degree of refining or coarsening; their effect on combined carbon in pearlite, and the effect on the matrix of the iron refining the pearlite, strengthening, hardening or producing the ferrite. Additional classification would cover their effect in connection with corrosion resistance in varying concentrations as to alkali or acid reactions.

At present the tendency in the production of glass molds is toward the use of comparatively small amounts of one or more alloys. As mold and glass reactions are better understood and where it is economically advisable we may expect to find more complex and more highly alloyed irons being used. Rather high alloy mixtures are made in the cupola but to do so successfully requires precise metallurgical control of every factor involved from raw materials to finished product.

This applies particularly to the melting process. Cupola operations may be handled to produce uniform results, but the nature of alloys is such that their melting and handling require a great deal of skill and proficiency as well as a knowledge of and method of making additions under the proper conditions and at the correct time and temperature. Where conditions and production warrant the expense, the use of an electric furnace alone or in duplexing operations should be considered carefully. Melting costs as a rule are higher, but are offset to some extent by the use of cheaper charge materials. However, in the production of high grade irons, whether for molds, automotive castings or any other purpose, hairbreadth uniformity may be obtained from heat to heat.

Chromium intensifies the chilling characteristics of cast iron, forms stable chromium-iron double carbides, has somewhat of a refining effect on graphite, increases the combined carbon and finally refines the matrix. Because of these effects chromium is of value even in small percentages. The structure of the iron changes with increasing amount of chromium from a small amount of ferrite at 0.30 per cent to fine graphite and pearlite at 0.60 per cent. With about 1.00 per cent chromium, fine graphite and pearlite with small carbides begin to appear.

This indicates that the particularly effective range for chromium additions lies between approximately 0.30 and 1.00 per cent. Larger percentages may be used but adequate steps must be taken to prevent formation of hard carbides because of effect on machinability, promotion of sticking of the ware, and a tendency to crack. A great deal of work is being done on cast irons with chromium as high as 35 per cent which have proved to be satisfactory in heat and corrosion resistance.

In "Effect of Small Percentages of Chromium on Cast Iron," *Transactions*, A.I.M.E., 1932, page 492, Burgess states that small percentages, within the range indicated do not seriously affect fluidity. The iron shows a distinct improvement in density by the elimination of porosity and refining of the (*Please turn to page* 101)

Hints ON MELTING NONFERROUS METALS

By N. K. B. PATCH

IN THE nonferrous foundry the melting practice is based on the double foundation (a) Melting simply is a means of converting the necessary metals into a fluid state to permit pouring into a mold to form the desired shape. (b) During melting certain fundamental mixing or alloying actions take place to produce the desired composition.

Obviously where the alloying or mixing of the component elements has taken place in the process of making ingots, melting these ingots in the nonferrous foundry is simply following out the fundamental practice under the heading *a*. In the interest of high quality it is always better practice to make the desired alloy and pour into ingots and then remelt the ingots for production of the desired molten metal to be poured into the mold. Where high grade ingot already is available in the market, metal which conforms satisfactorily to the desired specification, one step in the production of castings in the nonferrous foundry is eliminated by the purchase of high grade ingot from manufacturers. Ingot metal manufacturers of today have perfected manufacturing process to a high degree of uniformity.

Scrap Varies Widely in Composition

In view of the wide variety of compositions now regularly marketed in the form of castings to meet specific industrial requirements, the scrap metal coming back to be remelted is also of a wide variety of different compositions. Therefore, it is impossible to be sure of the composition of a given scrap casting without some definite knowledge of its source and history. Consequently, use of scrap without careful analysis of the different materials composing a given heat can result only in a composition, the elements of which are likely to vary within wide limits. Any attempt to meet specific requirements as to composition or physical properties is to say the least extremely difficult under such circumstances. Where the compositions are made from virgin metals, it is entirely possible to make a satisfactory product uniformly from day to day and hold the composition to accurately predetermined limits. Even here, the better practice is to make the composition from the raw materials by melting and alloying them and then pouring the resulting composition into ingots to be remelted.

Pour in Ingots and Remelt

If the best results are to be obtained, the foundry will be melting ingots and the gates and risers cut from castings poured from previous heats of the same composition. Borings and turnings, grindings and other similar types of scrap should be sent to the smelters equipped to melt them with minimum loss; or in other words, with maximum efficiency. The foundry that follows this practice will have either a department in which compositions are made up of predetermined standard and the ingots thus produced sent from that department to the foundry for future production of the castings; or, the ingot metals for the process will have been secured from one of the ingot metal manufacturers. Thus the foundry in melting its ingot metal raw materials only has to consider this one phase of melting, that of bringing to a sufficiently fluid state the desired metal for a given mold.

In the melting process two major precautions are to be observed. First, the proper furnace atmosphere must be maintained to insure the metal against the absorption of gases during exposure to the furnace atmosphere. Second, melting must not be continued beyond the desired fluidity for pouring the castings. The metal should not be superheated or soaked by keeping it in the furnace an undue length of time. In the first precaution, a number of factors influence the melting condition including, first, the type of fur- (*Please turn to page* 105)

Moisture Control Of Cupola Air

By JOSEPH L. BROOKS
Metallurgist
Muskegon Piston Ring Co.
Sparta Division
Sparta, Mich.

PROGRESSIVE foundrymen at all times are striving to eliminate variables in the process of melting metal. Raw materials are purchased under certain specifications. The materials are carefully checked upon their arrival at the plant so that the foundryman may be assured that the properties fall within the specified limits.

One important raw material which must be used in cupola melting of metal is air, and unfortunately Mother Nature gives no assurance that the properties of the atmosphere will remain constant from day to day.

In addition to other considerations, one of the principal reasons for recent interest in moisture control has been a vast improvement in methods and equipment for reducing and holding at a constant value the moisture in cupola air.

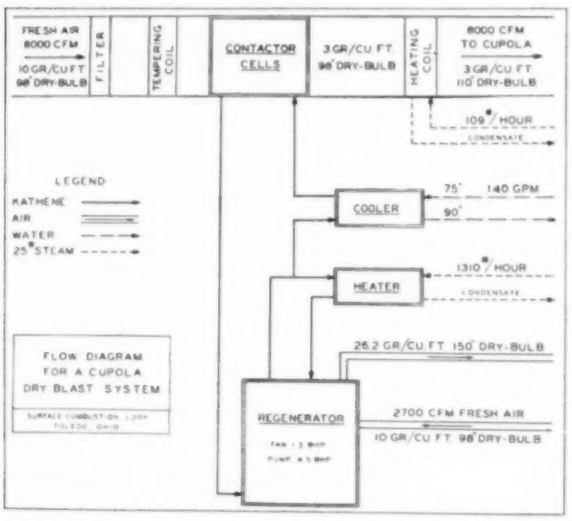


Fig. 1—Flow diagram for typical dry blast system for a cupola

The Sparta Division of the Muskegon Piston Ring Co. has for many years recognized the ill effects of varying moisture content of the atmosphere upon cupola operations. In the summer of 1927 an ice machine was installed to reduce atmospheric moisture in the cupola blast by refrigeration, the air being chilled to the point where the required amount of moisture was condensed out of it. As far as the cupola itself was concerned, the only useful work done by such a system was the moisture reduction. The temperature reduction not only was wasted work, but had to be compensated for by an additional amount of heat to raise the temperature again. This, of course, added to the operating cost. This equipment, however crude it may have been, clearly demonstrated the benefits of moisture removal in cupola blast.

Materials Absorb Moisture from Air

A more direct attack on atmospheric moisture was made by the use of certain solid materials that had the ability to absorb moisture in contact with them. In general, most of these systems functioned by switching automatically the flow of air from one bed of solid absorbent material to another on a definite time schedule. While one bed was removing moisture from the cupola air, another bed was being reconditioned by the application of heat.

In 1931 equipment of that type was installed in conjunction with the hot blast system. That equipment was far superior to the old home made refrigeration system, resulting in closer control and lower operating cost. Waste heat from the hot blast system was utilized to recondition the beds of absorbent material.

Several years ago equipment was developed for process air conditioning using a chemical liquid that had the ability to absorb large quantities of moisture from the air. The liquid used by this equipment is a lithium chloride solution, the strength of which is kept constant by con-

tinuously regenerating the solution as rapidly as it absorbs moisture from the air.

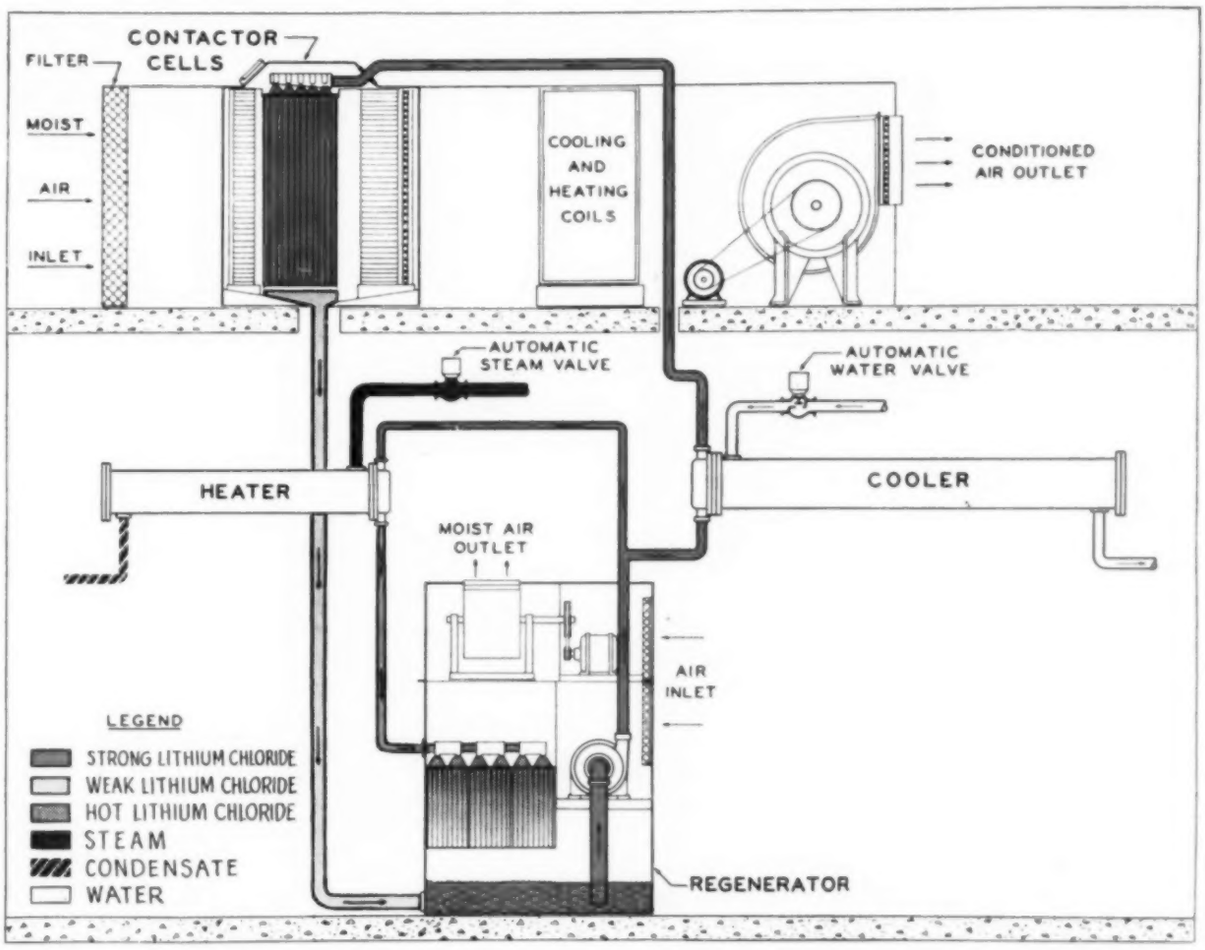
The two variables that govern the ability of a lithium chloride solution to absorb moisture are solution temperature and solution strength. Hence, in dry blast systems using that type of equipment it is possible to control directly the moisture content of air going to the cupola by controlling directly either solution strength or solution temperature. In most of these Kathabar systems, as they are called, the solution strength is held constant and the solution temperature varied so that just the correct amount of moisture is removed from the air at all times In the early spring of 1940 a system of that type was purchased from the Surface Combustion Corp., Toledo, O.

The flow diagram, Fig. 1, shows a typical system of that kind for cupola dry blast. Ir this particular system 8000 cubic feet of air per minute is taken directly from outside at a dry bulb temperature of 98 degrees and a moisture content of 10 grains per cubic foot. The air passes through dry filters before being introduced into the system so that the lithium chloride solution and heating coils are kept free from foundry dirt. The tempering coil, shown on the diagram, functions only in cold weather to keep the air temperature entering the system from dropping below 40 degrees.

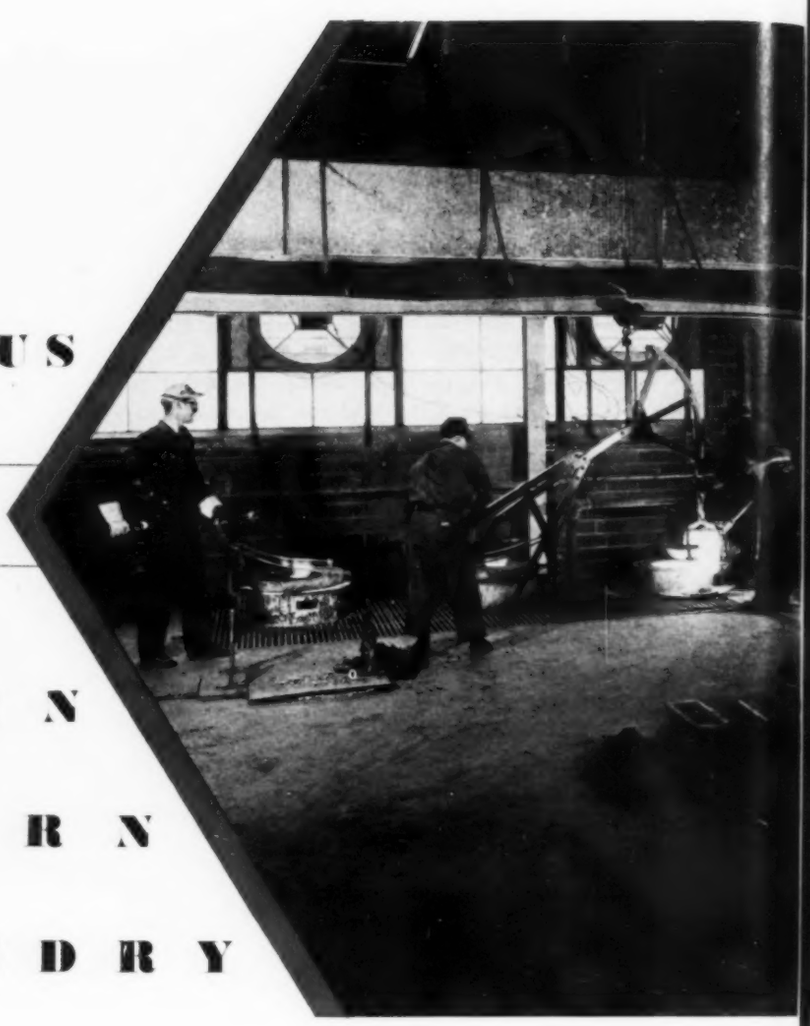
Two standard contactor cells, each handling 4000 cubic feet per minute, bring the cupola air into intimate contact with the lithium chloride solution. The solution flows continuously over a specially designed contactor surface in such a manner that absolutely no solution is entrained in the air. The air leaves the contactor cells at 98 degrees dry bulb and 3 grain of moisture per cubic foot.

At the entering moisture content of 10 grains per cubic foot, the air is giving up moisture to the lithium chloride solution at the rate of 63 gallons per hour. The solution flowing continuously over the contactor cells is, therefore, more dilute than the entering solution. To maintain constant strength of the solution entering the contactor cells, the excess moisture must be driven off continuously, somewhere in the circuit as rapidly as it is picked up in the contactor cells. This is the function of the Kathene regenerator, (*Please turn to page* 110)

Fig. 2—Diagrammatic representation of the system showing various agents employed



NONFERROUS *Castings* MADE IN MODERN FOUNDRY



IDEA that a foundry cannot be anything but dirty and dingy once again is disproved in the new nonferrous foundry recently placed in operation by the Hobart Mfg. Co., Troy, O., which manufactures electric food-preparing machinery, mills, meat choppers, potato peelers, mixers, dishwashers, scales, and slicers. Designed and built by the Austin Co., Cleveland, this new foundry is as clean, airy and bright as a model schoolroom. The new foundry has a capacity of 50,000 pounds of finished parts per month. Castings range in size from small, 1-ounce aluminum latch parts, to main frames that weigh 14 pounds.

In keeping with the campus like appearance of the plant grounds, landscaped buildings and expansive lawns, the new structure is of trim brick and steel construction. In the one story, monitor type building, continuous steel windows 10 feet high extend completely around the east, north, and west sides to permit maximum daylight illumination. South end of the building is walled off to provide completely separated working space for a tinning plant where iron castings are given a coating of block tin.

Departments within the foundry were laid out carefully for maximum efficiency of operations. West side of the building is devoted to aluminum, east side to brass. A low brick wall in the center prevents contamination of the metal of either department by that of the other. This wall, 50 feet long, is only 4 feet high—high enough to prevent mixture of sand or metal, yet not high enough to interfere with even distribution of light or with ventilation.

Along the north wall are the cleaning department, the office, and a cage for electric transformers, meters and other utility equipment. Along the south wall, adjoining the tinning plant, is storage space for ingots and sand, and a toilet room. The only connection between the tinning plant and the foundry is through the toilet room, which serves both departments.

The ingot storage room occupies approximately 350 square feet of floor space. Gates, sprues and other scrap for remelting are stored in 11 metal bins conveniently located just outside the storage room door across the delivery aisle. Brasses and bronzes used include red and yellow brass, bushing bronze, phosphorus gear bronze,

Fig. 1 (Left)—A cantilever type hoist is used to lift crucibles from the furnace. Fig. 2 (Right)—View across the aluminum pouring floor showing the 4-foot wall which separates the aluminum and brass departments

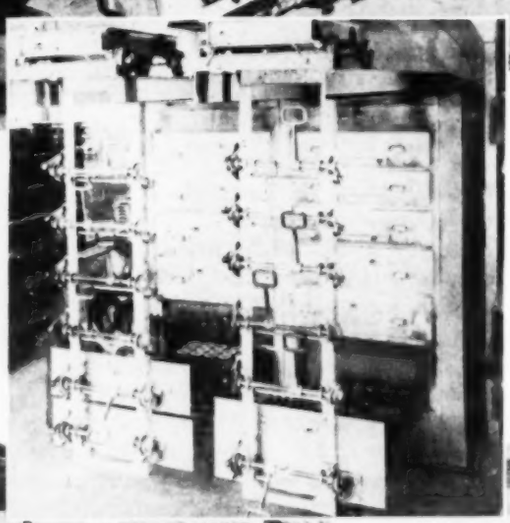
plastic high lead bronze and 20 per cent nickel-silver alloy. The aluminums include: 95 per cent aluminum, 5 per cent silicon; 90.5 per cent aluminum, 2.5 per cent silicon, 1.00 per cent copper; No. 1 and No. 12 remelt and a special titanium alloy. This latter is a high tensile alloy used for dough hooks, beaters, mixer whip shanks and similar parts for food mixing machines driven by high horsepower motors.

The old theory that a separate structure entirely apart from the foundry proper is necessary for the safe storage of patterns, floor flasks, and such other equipment is abandoned in this instance. Since the building is fire proof, storage space for pattern equipment is provided inside the foundry, on a mezzanine over the toilet room and the sand storage bins.

Entrance to the mezzanine is by abrasive topped stairs directly from the foundry floor opposite the end of the 4-foot high separation wall. Upstairs, to the west, wood floor flasks and core boxes are stored. This equipment usually piled outdoors in the yard at most foundries where it is subjected to the vicissitudes of weather, is thus kept dry and in good condition. Rusting of metal bars and hinges and the drying out and shrinking of rainsoaked wood is eliminated.

Patterns are stored to the east on the mezzanine. About 800 different active patterns are shelved according to index numbers on portable type metal shelving. All types of patterns are used, including loose patterns, follow boards and matchplates. The foundry has to stock an unusually wide range of different size slabs and boards because it is called upon from time to time to make service parts for obsolete models or for models originally made by other companies which have been absorbed by Hobart. This parts business is not enough to warrant standardization of either the patterns or the diversified methods of operation.

Three sand bins, each 7 feet 11 inches by 19 feet 4 inches under the mezzanine, have a total capacity of between 150 and 175 tons. Three

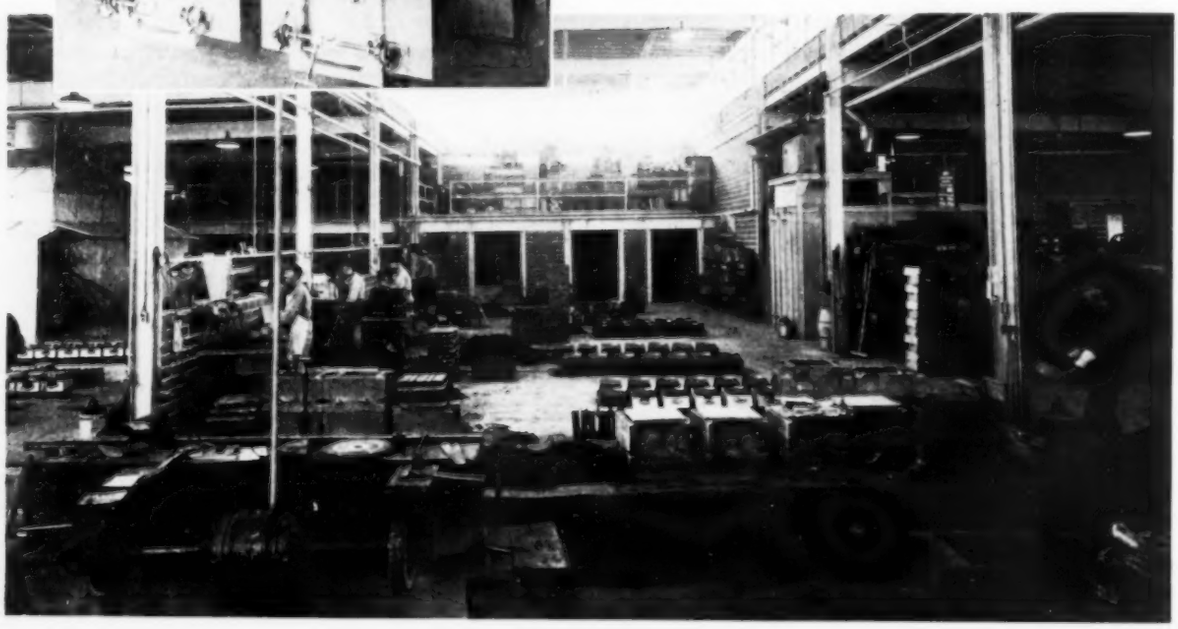


different grades of sand are required for molding and for cores. A portable sand conditioner throws the sand into the bins from the dump trucks.

Most of the equipment in the foundry was installed new with the building. The core oven is a latest type recirculating unit with complete safety equipment. It is a 12 drawer, double unit oven with a shelf capacity of 150 square feet and is fired with natural gas. Automatic controls maintain constant temperatures, and an exhaust fan draws out fumes and smoke. The oven is located in the south corner on the west or aluminum side of the building, near the sand mixer and shelving for core storage. Coremaker's and molder's benches, of all metal construction, are located close to the windows.

Aluminum is melted in three furnaces, two with a capacity of 250 (*Please turn to page* 104)

Fig. 3 (Above)—Ten-foot windows form a glass band around three sides of the foundry. Fig. 4 (Upper Left)—Pouring brass from the crucible. Fig. 5 (Left)—Drawer type core oven. Fig. 6 (Below)—Another view of the aluminum department. Illustrations courtesy the Austin Co.



Surface Containing Fine Detail Is Not Quite Satisfactory

We are using a dry sand core mold for a casting containing a number of fine beadings and other impressions. These castings must be poured with exceedingly hot iron. We have tried spraying the cores with graphite, plumbago, talc and silica flour, but the surface of the casting is not quite satisfactory. Cores are made from typical radiator core sand bonded with oil. We shall appreciate any information on a suitable facing sand and core wash.

So far as we know the materials you have tried on the cores cover the available list of core washes. The sand you are using is satisfactory for radiator castings which are poured at a fairly high temperature. If we assume that the unsatisfactory appearance of the castings is caused by spraying the wash over the face of the core, thereby blurring the sharp lines and fine detail, a possible remedy is to use a variation of the method known as *stamping back* practiced in stove plate foundries.

First a deposit of mineral blacking—graphite, coal or coke—is shaken over the surface through a bag. This is followed by a light dusting of charcoal blacking. The pattern then is returned to place and rapped down gently. Wet blacking of course presents a slightly different problem. However, if the blacking is allowed to air dry for a short time, we are inclined to the opinion that an oiled pattern, or suitable duplicate part, could be stamped on the face. If your trouble simply means that the core sand does not produce a sufficiently smooth surface, this can be remedied by adding 10 to 15 per cent fine molding sand to the mixture. We suggest you consult with the manufacturers of core washes represented in the advertising pages of THE FOUNDRY.

Sand Moisture Tester Is Useful Device in the Foundry

We shall appreciate your opinion on whether a sand moisture tester is of any practical benefit in a jobbing gray iron foundry. Our facing sand is mixed more or less by rule of thumb and we are inclined to the opinion that part of our casting trouble is due to that practice. Our question may seem amateurish, but we do not want to invest in a device or instrument if it has not some real value.

Devices for measuring the moisture content of sand, in fact all the pieces of apparatus developed in recent years for scientific sand control, are of distinct commercial value. They represent the first successful attempt to reduce the many sand variables to a practical working basis. This does not necessarily mean that the purchase of a moisture tester will solve every problem in the foundry. Of course, you are aware that the production of a casting involves a definite sequence of operations. All the movements in the sequence have to synchronize. Condition of the sand presents a hazardous variable, but the moisture tester removes that particular variable. The instrument is a checking device. A competent man familiar with local conditions and with the sand should set up definite standards for grain size, permeability, bond and moisture content. With these standards established, any person can use the instrument and note if the moisture content of the sand is correct. Naturally, the instrument has widest application in production foundries where a sand uniform in all particulars is required to produce a uniform grade of castings, where the sand is prepared mechanically and supplied to the molding machine operators. However, moisture testers are used successfully in many jobbing shops where moisture conditions in various heaps may vary considerably.

Sand Sticking to Brass Castings Results in Much Trouble

We operate a small brass shop making all kinds of brass castings. We have trouble removing sand from the castings with a wire brush, the only means available. Is there a pickling process which removes the sand, and improves the casting?

Pickling is a troublesome and messy operation, and usually does not work satisfactorily unless it has been standardized for one particular alloy so that it is a more or less automatic procedure. One satisfactory way to remove sand from the castings is to shake them out when they are just slightly red in color and plunge them into cold water. The steam generated blows the sand from the surface and gives a good appearance.

Since you have no abrasive blasting apparatus, it might be a good idea to use rotating wire brushes in a variety of widths, and length of bristles to reach into pockets of various sizes. Also there are inexpensive abrasive blasting units that can be purchased. It might be pointed out that choice of molding sands, methods of molding and ramming will influence the amount of sand that sticks to the casting. Proper facing on the mold such as plumbago or floor in the case of light section, red brass castings will reduce adherence of the sand.

Dry Sand Cores Cut On the Surface

For the past month or six weeks we have had a peculiar experience with our cores in gray iron castings from 300 to 1000 pounds weight. One day the cores function satisfactorily and leave a perfectly smooth surface on the castings. On the following day duplicate cores used under duplicate conditions wash and cut to an alarming extent. The cores are made from a mixture containing 3 parts sharp sand, 1 part bank sand, 2½ parts loam bonded with a cereal binder 1 part to 30 parts sand. The cores are painted with a good grade core wash.

We are inclined to the opinion that an important word was omitted in this inquiry. That is the word *apparently*. The cores one day are perfect. On the following day the same type of cores *apparently* made from the same sand and binder with no change in manipulation, or baking procedure, cut and wash. Apparently all the conditions are the same in both cases, but ordinary reason indicates a slip or a change of some kind in the core making technique. Obviously a close check by an experienced man over every item will be required to find the weak or missing link.

The first point to determine accurately is whether the cores are washing or scabbing. Unfortunately the terms are used rather loosely in the foundry and unless sharp differentiation is made between them the investigator may be led astray. A wash or a cut results where the sand is weak, burned or loosely bonded. The flowing stream of metal erodes the surface to a greater or lesser extent depending on the weakness of the sand, temperature and velocity of the metal, and the time the stream is in motion over the sand. A scabbed or blistered area on a core, reproduced in obverse on the face of the casting is caused by steam or gas pressure inside the core. The pressure dislodges flakes or patches of sand.

While the appearance of both types of defects in certain instances is almost alike, a close examination by an experienced man will decide which is which. He then is in position to apply appropriate remedies. Your present core sand mixture conforms to the usual practice for cores that do not require maximum permeability. The clay content derived from the molding sand is too high where free and rapid exit of the gas is of prime importance. The possibility exists that the permeability is just on the border line.

A slight change in the mixture might tip the balance from day to day. The cores may be cutting or washing, but we are inclined to the opinion that the fault is inside instead of outside and is caused by low permeability. If the defect is a true cut or wash, it may be traced to cores scorched in the oven or to sand not mixed properly to insure complete and uniform distribution of the binder. If the defect is a scabbed area, it is caused by a core that is too hard, or too tight, or is not sufficiently dried. The remedy for the first and second items is to reduce the amount of binder. This can be done by cutting down on either the molding sand content, or the cereal binder, or possibly both.

Clay Employed for Coating Molds

We are attempting with only partial success to make small iron castings in permanent molds. Molds are heated and maintained automatically at a temperature of approximately 500 degrees Fahr. The castings are small plates ⅝ x 3½ x 5 inches and one face must be perfectly smooth and clean. Can you tell us what kind of coating is used on molds of this kind and how to prevent surface blows.

The most widely used coating for permanent molds is kaolin (china clay) made into a thin claywash with sodium silicate (water glass). A thin film of the material is sprayed or brushed on the face of the heated mold before the mold is placed in operation. If necessary small areas are repaired between heats, but in other instances the mold is removed from the assembly, coated and dried. Duplicate molds usually are on hand to permit continuous operation of the machine. In addition to the clay coating the faces of the molds are *smoked* with an acetylene torch each time before the metal is poured into them. Your attention is directed to the fact that the process is patented.

Your reference to surface blows and the necessity for a perfectly smooth surface on at least one face of the casting leads us to wonder if perhaps some factor other than the coating is responsible for your trouble. Blows are caused either by rust or steam. Obviously if the agent for producing either of these items is present, the coating is no protection. Before the coating is applied the working face of the mold must be cleaned perfectly. Later the coating material must be thoroughly dried. Another factor to be watched carefully is the pouring speed. Presumably the mold is mounted with the joint in a vertical position. Cold iron, or iron that is poured too slowly will creep up the sides of the mold in a series of irregular waves.

Holes in Castings Result from Gas

We are sending two sample castings which show gas inclusions often occurring in our work. Metal is 85 per cent copper, 5 per cent lead, 5 per cent zinc, 4.25 per cent tin, and 0.75 per cent nickel, and is melted in an oil-fired furnace with a slightly oxidizing flame; fluxed before pouring with 1 per cent zinc. It is covered with glass and a small amount of sand. Pouring temperature ranges between 2100 and 2200 degrees Fahr. Sand is No. 1 Albany opened up with No. 1½. Cores are made from a mixture of lake sand, bank sand and a little No. 1½ Albany sand with a cereal binder. The trouble with gas holes just has recently occurred.

Examination of the samples indicates that the trouble is caused by several conditions, and it is hard to determine which is doing the most damage. One cause is improper melting, and it is suggested that you examine your furnace to see that the shape of the lining of the furnace, burner orifice, etc. are in the proper condition. Ingot metal should not be laid across the top of the furnace hole to warm up before placing in the pot since it will absorb gas.

The alloy you are using is sensitive to sand conditions. Very fine to large rounded pinholes are not an infrequent result of low permeability and high moisture conditions. It is suggested that you compare your present and past sand practice by use of the A.F.A. sand tests. Such a comparison is worth many opinions. The 85-5-5-5 alloy is quite sensitive to organic binders, either in the cores or in the sand, and the effect has been shown to be cumulative. Remedy is to have the cores open, well vented with the minimum binder, and keep the binder out of the molding sand.

Pouring temperature seems high for the alloy unless the castings are intricate and of light section. Often material benefit may be realized by dropping the temperature 50 degrees or more—just sufficient to run the castings. Gassing from the sand is minimized in that manner. You do not mention furnace temperature, and overheating often is a contributing factor. Long before the furnace atmosphere is bad enough to cause pinholes, it results in metal showing internal porosity and microscopic incipient shrinkage—castings leak under hydraulic pressure, and after test show dark or discolored fracture. Flame appearance is a poor indicator of operating conditions, and it is advisable to check combustion conditions with an Orsat or similar gas analysis apparatus.

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Boiled Linseed Oil Is Misnomer

Is boiled linseed oil used as a core binder in gray iron foundries? If it is, what are the advantages or disadvantages as compared with raw linseed oil?

Quoting from a publication issued by a manufacturer of linseed oil: "The word *boiled* in connection with boiled linseed oil is somewhat of a misnomer. By boiled, it would be understood that the oil was brought up to the boiling point, which is not the case. Linseed as well as other vegetable oils, decomposes long before the boiling point is reached. Boiled oil derives the name from the mere fact that in order to be prepared it has to be heated."

The difference between raw linseed oil and boiled linseed oil lies in the time required to dry a thin film as in paint, simply exposed to the atmosphere. Since the binder in a core is dried under radically different conditions, one type of oil presents no particular advantage or disadvantage over the other. The raw oil is used satisfactorily by many coremakers. The boiled oil, favored by others, contains a small amount of a dryer, a catalytic agent, lead, manganese or cobalt, which intensifies the drying action by transferring oxygen from the air to the oil without being affected itself. In this connection it may be apropos to point out that the bulk of core oil consumed in the foundry is an oil with a linseed base, but containing other ingredients designed by the core oil manufacturers to render the oil more suitable for use as a core binder.

Straighten Rim on Sheave Wheel

We have a complaint from a customer that a 10-foot diameter single groove sheave, cast iron rim and hub and bicycle spokes, does not run true. At one point the deflection amounts to ⅜-inch. We have made wheels of this type for many years and never had a complaint of this kind before. We shall appreciate your opinion on the probable cause of the warpage and the possibility of salvaging the present wheel.

Presumably the bottom of the groove was machined before it was shipped from your plant, therefore the path for the rope must have been straight and true. We cannot imagine any set of conditions that would throw it out ⅜-inch either on the journey, or while it was on the company's property awaiting erection. Since you are faced with the alternative of supplying a new wheel or putting the present wheel in running order we should favor an attempt to straighten it. If the experiment does not prove satisfactory the cost will be comparatively trifling. The following outline of method is submitted for your consideration: The entire casting must be raised to a red heat.

Under ideal conditions the casting would be placed in a furnace, raised to a red heat, lifted out and placed on a surface plate. The affected part of the rim would be forced down against the plate with jack screws or a suitable weight and allowed to cool in that position. However, since the present job in all probability will have to be performed in the field, another type of procedure will be necessary.

Set the wheel up horizontally on 8 or 10 piers about 8 inches above the ground. The pier under the center of crooked part will be ½-inch short of touching the casting. A good wood fire will raise the casting to a red heat. Then a weight of a ton or more is placed on the affected part of the wheel rim and left there until the casting is cold enough to handle. The weight will press it down until it touches the pier, and the pier will prevent it from going too far. In cooling it will spring back a little, hence the provision of the extra ⅛-inch of space between the rim and the pier.

Scum Floats Upward In a Core Mold

We are forwarding a cast iron valve disk 5 inches in diameter, 1¾-inches thick, made in a dry sand core, except the cope which is green sand. Core is baked very hard and given a coating of zirconite. We have tried various types of gates, methods of pouring and have taken every precaution to prevent entrance of slag. Imperfections appear on the drag face, while slag spots and worm holes appear on the cope side.

Appearance of the casting indicates that the metal did not lie quietly in the core. The boiling or bubbling action produced the slushy material which floated to the top, also the slight imperfections on the drag face. Direct cause may be either a hard, tight core, or a hard rammed green sand drag through which the vent from the core cannot escape readily. Presumably the castings are molded four in a flask, consequently practically all the gas generated in the cores has to pass down through the surrounding sand. Obvious remedy is a highly permeable core resting in a mold where the gas can escape instantly. A change in the core sand mixture may be necessary to secure increased permeability. Possibly the present sand mixture may be continued with the amount of binder cut down to the minimum. Again, the face of the corebox may be lined with a fine grade of sand to reproduce the design on the face of the casting. The remainder of the space then can be filled with a coarse, open mixture.

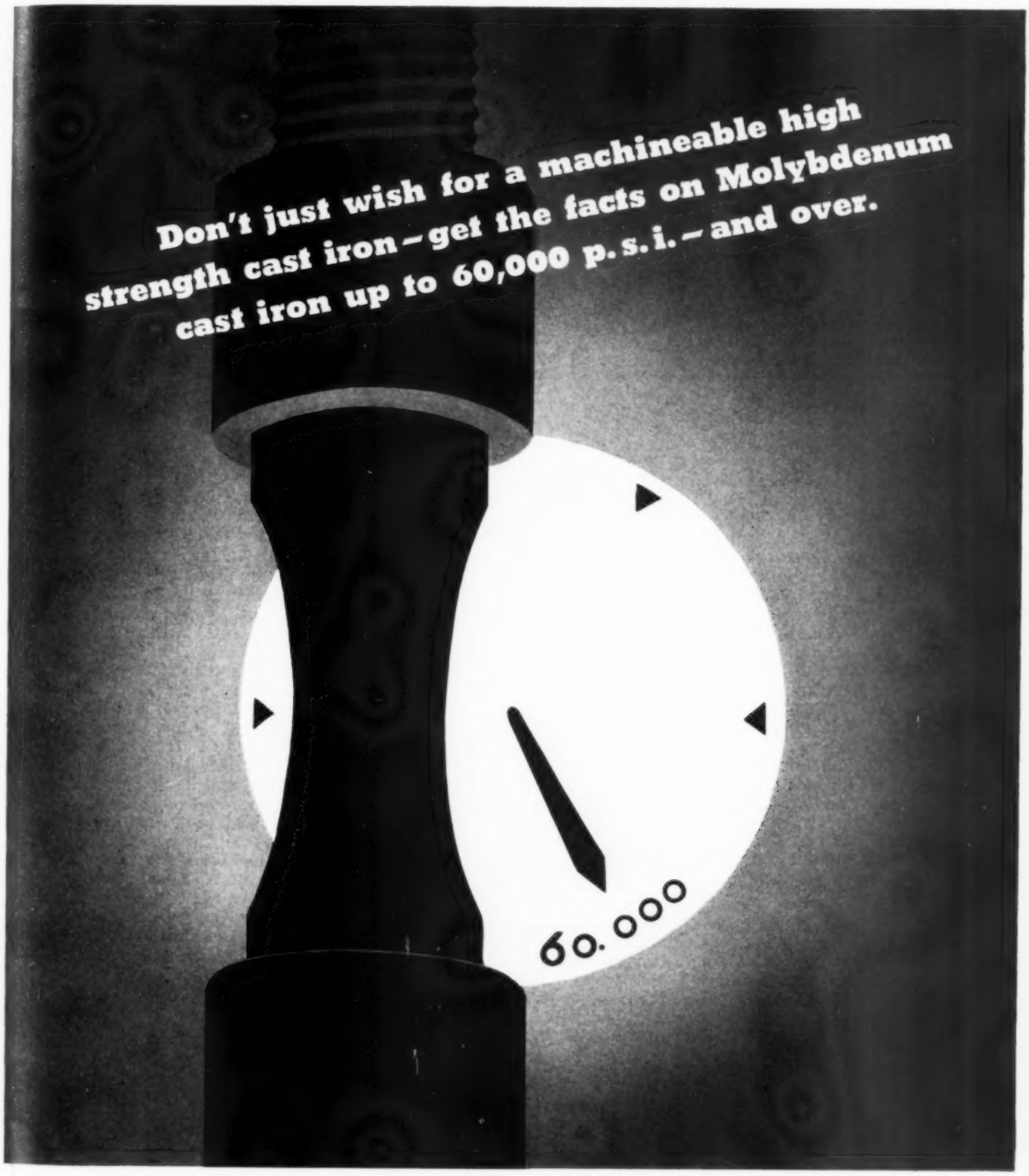
Oil and Grease May Cause Gassing

In your magazine we have read in several articles on nonferrous foundry practice that brass melted in an indirect arc electric furnace should be free from any oil or grease. Please explain just what effect the oil or grease has, or what reaction takes place.

In the first place when a charge is weighed up due allowance must be made for the weight of the grease and oil if the proper proportions are to be maintained so that the desired composition will result from a melt. However, this is not a very important item. The more important factor is the effect of the combustible material on the type of atmosphere within the furnace to which the metal is subjected during the melting process. If oil or grease is present, it will burn and use up oxygen in the furnace atmosphere, frequently to a point where the combustion of the electrodes and the oil result in an underburnt condition of the gases.

Underburnt gases are definitely soluble in the metal at elevated temperatures and the melting charge becomes gassed. An undue amount of moisture on the borings is also a source of trouble, since at an elevated temperature moisture frequently breaks up into the elements hydrogen and oxygen. Hydrogen is highly soluble in nonferrous metals and after being dissolved it is difficult to throw it out of solution without solidifying the metal itself. It comes out of solution and forms blow holes as the metal becomes solid and defects result. Therefore, you will see that dry, clean borings are preferable.

The best method is to melt your borings or scrap and pour into ingots, carefully skimming the metal before pouring. This process will burn up the grease, and while during melting of the borings the metal may become gassed, the gases will be thrown out of solution when you pour the metal into the ingot molds. When ingots are remelted you will have good clean metal. The gases having already been thrown out of solution, the metal will be gas free unless it is *again* gassed during this second melting process by reason of the presence of reducing gases.


Don't just wish for a machineable high strength cast iron—get the facts on Molybdenum cast iron up to 60,000 p.s.i.—and over.
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500 Fifth Avenue · New York City

MOLY

MEN of INDUSTRY

R. C. HEASLETT, director of metallurgy, Continental Roll & Steel Foundry Co., Pittsburgh, recently was elected president of Pittsburgh Foundrymen's association. Mr. Heaslett graduated from Ohio State university, Columbus, O., after specializing in chemistry, and then became assistant chemist, Follansbee Bros. Co., Follansbee, W. Va. Later he was chief chemist and then metallurgist of the Wheeling Mold & Foundry Co., Wheeling, W. Va. Following that he was appointed metallurgist for the Continental Roll & Steel Foundry Co., and was made director of metallurgy in 1937. Mr. Heaslett is a member of the American Society for Testing Materials, the British Iron and Steel institute and the American Society for Metals.

♦ ♦ ♦

WILLIAM J. SCHIPPE recently became connected with the C. S. Bell Co., Hillsboro, O., in charge of the inspection department and production engineer. Mr. Schippe started his industrial experience at the age of 16 in the foundry of the Wisconsin Ornamental Iron & Bronze Co., Milwaukee. In 1936 he became connected with the General Malleable Corp., Waukesha, Wis., where he served in several capacities in the aluminum and gray iron divisions. Mr. Schippe also has been connected with the L. J. Mueller Furnace Co., Milwaukee, and the Spring City Foundry Co., Waukesha, where he worked in the inspection department.

♦ ♦ ♦

R. J. ALLEN, recently elected chairman of the Metropolitan New York-New Jersey Chapter of the A. F. A., is consulting metallurgist, Worthington Pump & Machinery Corp., Harrison, N. J. Mr. Allen was born in Port Huron, Mich., and was graduated from the University of Toronto in 1913 with a degree of bachelor of applied science. After several miscellaneous connections, he became metallurgist for Rolls Royce of America, Inc., Springfield, Mass., and held that position until the company discontinued operation in this country in 1930. He then became chief metallurgist for the Worthington Pump & Machinery Corp. with direct supervision over such activities in all of the corporation's plants.

♦ ♦ ♦

F. RAY FLEIG, general manager, Smith Facing & Supply Co., Cleveland, recently was elected president of the Northeastern Ohio Chapter of the A. F. A. Mr. Fleig was born in Cincinnati in 1892, was educated in the public schools of that city and Belleville, Ill., and was graduated from Illinois academy and University of Illinois. In 1913 he went to Cleveland and joined the Smith Facing & Supply Co. which his father had established in January of that year, after the purchase of the old Cleveland facing mills which had been operated under lease by the J. D. Smith Foundry Supply Co., of which Mr. Fleig's father was one of the incorporators in 1890. Mr. Fleig worked in the office, plant, and sales department until the outbreak of the war when he enlisted in the air service. He was trained at Park field, Millington,

(*Continued on page* 50)

R. C. Heaslett

William J. Schippe

F. Ray Fleig

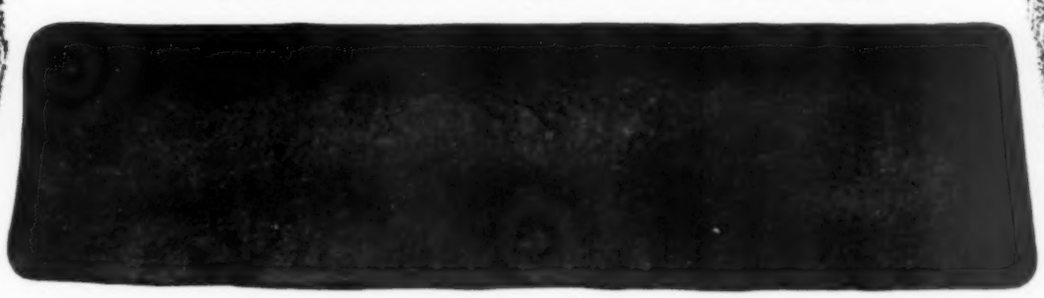
R. J. Allen

UNIFORMITY the Watchword of WOODWARD

Keenly jealous of the reputation it has earned in the foundry trade for making pig iron of outstanding uniformity, Woodward focuses the complete facilities of its entire organization on that single end. Both production and policies of Woodward are keyed and synchronized at all times to the maintenance of ***uniformity in product*** and ***uniformity in service to the customer.*** Among the factors which account for the uniformity of Woodward iron and Woodward service are:

Uniform ores, with the base ore burden always from the same ore body.
Uniform coke, all from the same coal measure.
Uniform screening and grading of both ore and coke.
Uniform control of humidity in the blast thru air-conditioning.
Uniform policy thru 57 years of making nothing else but pig iron.
Uniform customer service thru established sales agencies in all leading markets.

To you, these factors mean that you can count on Woodward as a uniformly dependable source of supply for uniformly good pig iron.



WOODWARD IRON COMPANY

WOODWARD, ALABAMA

America's Largest Completely Integrated and Entirely Independent Merchant Iron Producer

INDEPENDENT SINCE 1883

(*Continued from page* 48)

Tenn., and his squadron saw active service with the air force in France. Returning to the United States in August, 1919, he again became connected with the Smith Facing & Supply Co. He first went into the mill to learn the manufacturing end of the business and eventually took complete charge of that department, rebuilding the entire plant and processes. Mr. Fleig has been vice president of the company since 1913, was made assistant manager in 1920 and general manager in 1930.

♦ ♦ ♦

FRED KAIM, Union Brass & Metal Mfg. Co., St. Paul, recently was elected president of the Twin City Foundrymen's association. Mr. Kaim received his education at the Cretin Military academy, St. Paul, and the University of Minnesota, Minneapolis, where he received the degree of chemical engineer in 1932. Immediately after graduation he entered the employ of the Union Brass & Metal Mfg. Co., manufacturers of plumbing fittings. From 1932 to date, he has had charge of designing and complete supervision of the foundry and plating departments. Mr. Kaim has been active in the work of the Twin City Foundrymen's association for a number of years, and has served on numerous committees.

♦ ♦ ♦

E. C. MADSON, manager of the foundry division, the Anderson Foundry Co., Bayport, Minn., recently was elected vice president of the Twin City Foundrymen's association. Mr. Madson received his education in the public schools of Stillwater, Minn., and graduated from high school in 1922. He then decided to learn the lumber business and found employment with the Anderson corporation at Bayport. In 1930 he was made manager of the foundry division of the corporation, the Anderson Foundry Co., which manufactures sash pulleys. Mr. Madson has been active in the work of the Twin City Foundrymen's association and has served as a member of the executive committee for the past 6 years.

♦ ♦ ♦

JOHN A. WAGNER, president, Wagner Malleable Iron Co., Decatur, Ill., was elected president of the Malleable Founders' society at the recent annual meeting. Mr. Wagner attended school at Milwaukee and later Culver Military Academy, Culver, Ind. He was graduated from Rose Polytechnic institute, Terre Haute, Ind., in 1918. The following year was spent in the United States Marine corps and at the close of the war, he became connected with the Wagner Malleable Iron Co. He became president upon the death of his father early in 1933.

♦ ♦ ♦

W. J. DAWSON, director, Hadfield Ltd., Sheffield, England, recently was awarded the E. J. Fox gold medal of the Institute of British Foundrymen in recognition of his work on steel castings and particularly as chairman of the steel castings research committee set up by the British Iron and Steel federation, and the Iron and Steel Research council. Mr. Dawson completed the full course in metallurgy at the old technical school, Sheffield, which later became the department of metallurgy, Sheffield university. He gained an associateship in metallurgy at the age of 18. His first post was in the laboratory of Sir Henry Bessemer's works. Three years later he joined Hadfield Ltd. as an analytical chemist, but after a brief time was put in charge of the steelmaking plant of the Hecla works. During the World war he was promoted to the position of metallurgical manager, taking complete control of the entire metallurgical activities of the firm, including the production of steel. In 1919 he was given a seat on the board of directors. Mr. Dawson has been closely associated with the researches of Sir Robert Hadfield. He has taken a prominent part in the development of austenitic and other types of heat and corrosion resisting steels. He has been a member of the steel castings research committee since its inception in 1928, and was chairman from 1934 when it was reconstituted.

♦ ♦ ♦

JAMES E. EPPLEY, superintendent, Kinney Iron Works, Los Angeles, recently was elected chairman of the Southern California Chapter of the A.F.A. Mr. Eppley learned the molder's trade at the Duncan Foundry & Machine works, Alton, Ill., starting in 1904. After becoming a journeyman molder he worked at St. Louis and Chicago, and later was appointed foreman at the Duncan foundry. In 1911 he was made foundry superintendent of Smith & Sons Mfg. Co., Kansas City, Mo., and later was appointed foundry superintendent, Weber Engine Works, Kansas City. In 1914 he went to Waterloo, Iowa to become superintendent of the Black Hawk foundry and remained there until 1917 when he became connected with the John Deere Tractor Co., as foundry superintendent. In 1917 he went with Montgomery Ward & Co., Chicago, and worked with that organization in the building of a new foundry at Springfield, Ill. In 1920 he returned to Waterloo, Iowa as foundry superintendent of Construction Machinery Co., and remained with that company until 1929 when he was made foundry superintendent of the Badger Foundry Co., Racine, Wis. In 1935 he was made foundry superintendent of the gray iron division, Claffey Castings Co., and General Malleable Corp., Waukesha, Wis. He was made superintendent of the Kinney Iron Works in 1936. Mr. Eppley was one of the first members of Southern California chapter.

(*Concluded on page* 52)

E. C. Madson

Fred Kaim

W. J. Dawson

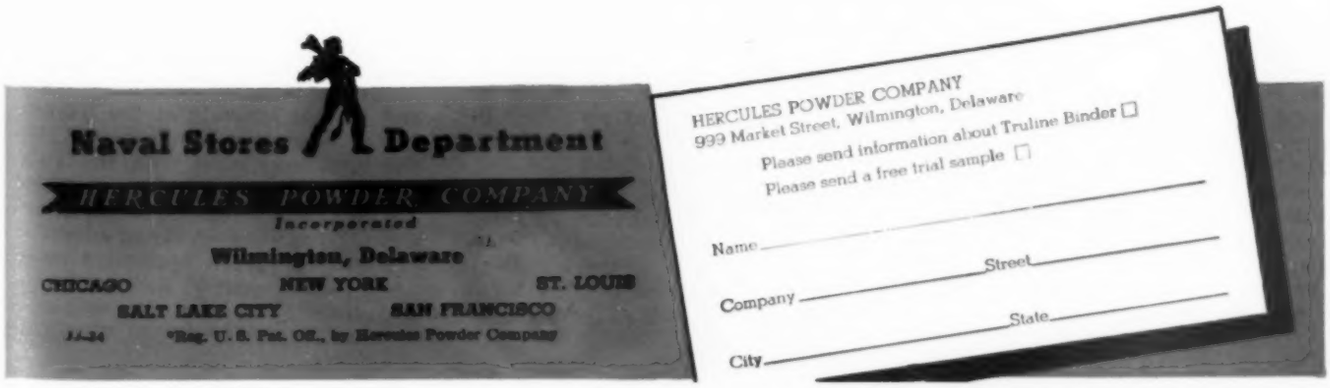
James E. Eppley

This low-cost material can be purchased so economically, and used in so many ways, it's no wonder that so many foundries are saving money.

With this one versatile material, you can make accurate cores that collapse completely, give them a smooth wash, and face your molds, too. Thus, you get sound castings that are clean, smooth, true to pattern.

For Truline Binder* is used as a core binder, a binder in core washes, and an ingredient of mold-facings. It is easy to handle and mix, bakes and dries surely, and resists the cutting action of hot metal. It burns out completely, reduces cleaning costs, and cuts down rejects due to cracks or scabs. Particularly important is its binding action and easy drying in cores containing a high proportion of black sand.

Put Truline Binder to work saving money in your foundry. The coupon below involves no obligation. It is merely a request for more information. Mail it today.



(*Concluded from page* 50)

WILLIAM W. BARNES, manager at Philadelphia for the Air Reduction Co., New York, retired recently after being associated with the oxy-acetylene industry for 30 years.

♦ ♦ ♦

DR. D. NICONOFF recently has resigned as research metallurgist with the Battelle Memorial institute, Columbus, O., and has joined the staff of Republic Steel Corp., Canton, O

♦ ♦ ♦

A. OAKLEIGH BUSH, formerly acting general manager of the English plant of the Norton Co. at Welwyn, recently has been appointed assistant chief sales engineer of the abrasive division, Norton Co., Worcester, Mass.

♦ ♦ ♦

DR. G. H. CLAMER recently was elected president and general manager, Ajax Electrothermic Corp., Trenton, N. J. R. N. BLAKESLEE JR. was named vice president and assistant general manager, A. D. MEYER, treasurer, F. T. CHESNUT, secretary, and I. PROWATTAIN, assistant treasurer.

♦ ♦ ♦

ROBERT GREGG, foundry superintendent, Reliance Regulator Co., Alhambra, Calif., recently was appointed to the board of directors of the Southern California chapter of the A.F.A. succeeding Jack Eberhardt who has moved to Cicero, Ill. Mr Gregg was a leader in the organization of the chapter.

♦ ♦ ♦

JACK EBERHARDT, formerly with the Kay-Brunner Steel Products Inc., Alhambra, Calif., has been made foundry superintendent of Electrocast Steel Foundry Co., Cicero, Ill. Mr. Eberhardt was a director of the Southern California chapter of the A.F.A. and served as chairman of the entertainment committee.

♦ ♦ ♦

MERLE C. NUTT recently was elected president, Moline Iron Works, Moline, Ill. He succeeds his father, L. E. NUTT, who has become chairman of the board. Other officers are: Vice president and treasurer, B. V. NUTT; vice president in charge of operations, J. L. MILES; secretary, J. F. ENGSTROM.

♦ ♦ ♦

GLENN COLEY, metallurgist, Detroit Edison Co., Detroit, is the new chairman for the Detroit chapter of the A.F.A. A graduate of the University of Illinois in chemical engineering in 1917, his experience includes mechanical and metallurgical work with Illinois Steel Co., Timken-Detroit Axle Co., Fansteel Products, Titusville Forge Co., and since 1928, the Detroit Edison Co. Mr. Coley is a member and past chairman of the Detroit chapter of the American Society for Metals and a member of the American Institute of Mining & Metallurgical Engineers, Society of Automotive Engineers, Electrochemical society, and the Engineering Society of Detroit. A charter member of the latter organization, he was active on the affiliate council 1936-37; a director since 1937; assistant-treasurer 1937-38; and

Glenn Coley

treasurer and chairman of the finance committee since 1938. He has been a member of the A. F. A. for 10 years, and has served on the Detroit chapter's board of directors for several years.

♦ ♦ ♦

HOWARD R. SALISBURY, formerly assistant manager at Philadelphia for Air Reduction Co., New York, recently has been appointed manager for that district, succeeding WILLIAM W. BARNES, retired. H. B. SEYDEL, formerly assistant sales manager of the New York district, has been appointed assistant manager at Philadelphia.

♦ ♦ ♦

JOHN L. LOWE, formerly foundry manager, Vilter Mfg. Co., Milwaukee, recently has been appointed foundry engineer on the technical staff, Battelle Memorial institute, Columbus, O., where he will take an active part in an extensive research program on the production of gray cast iron sponsored at Battelle by the recently organized Gray Iron Research institute.

♦ ♦ ♦

RALPH SCHOWALTER recently was made manager of the pattern shop of the Excell Brass & Aluminum Foundry, Pekin, Ill. Mr. Schowalter served his apprenticeship in pattern-making at Deere & Co., Moline, Ill. After leaving that organization in 1927 he worked for several companies in the Tri-City area and in 1930 became connected with the Climax Engineering Co., Clinton, Iowa, in the pattern department.

♦ ♦ ♦

GLENN W. MERREFIELD recently resigned as superintendent, Warman Steel Casting Co., Vernon, Calif., to become associated with the Continental Roll & Steel foundry Co., East Chicago, Ind. Mr. Merrefield was vice president of the Southern California chapter of the A.F.A., and took an active part in the apprentice training work of the chapter.

♦ ♦ ♦

ARTHUR J. TUSCANY, Tuscany, Turner and Associates, Cleveland, recently was elected chairman of the Cleveland District committee of the American Society for Testing Materials. ARTHUR W. CARPENTER, B. F. Goodrich Co., Akron, O., was named vice chairman, and W. W. ROSE, Gray Iron Founders' society, Cleveland, secretary.

♦ ♦ ♦

ROBERT J. BRANDT recently has been made foundry engineer, Webster Mfg. Co., Tiffin, O., producer of material handling and power transmission machinery. Mr. Brandt received his training at Fenn college, Cleveland, and Ohio State university, Columbus, O. Formerly he was employed by the Lufkin Foundry & Machine Co., Lufkin, Tex., and the Bonney Floyd Steel Casting Co., Columbus, O.

♦ ♦ ♦

GEORGE E. CARLIN recently was appointed foundry foreman, Vierling Steel Works, Chicago. Mr. Carlin previously was connected with the foundry of the Champion Corp., Hammond, Ind., United Boiler, Heating & Foundry Co., Hammond, and the Elevator Supply & Repair Foundry, Chicago. Recently he was with the Continental Roll & Steel Foundry Co., East Chicago, Ind.

♦ ♦ ♦

R. C. HARRELL and C. M. WOOLFOLK, recently have organized the Industrial Equipment & Service Co., headquarters at 513 North Twenty-first street, Birmingham, Ala., to serve the foundry and machine shop trade in Alabama, Georgia, Tennessee and Mississippi. Mr. Harrell formerly was connected with the Stockham Pipe Fittings Co., Birmingham, and Mr. Woolfolk is a graduate chemist from the University of Iowa, Iowa City, Iowa, and recently has been connected with the Grasselli Chemical Co., and the Hercules Powder Co.

♦ ♦ ♦

M. A. CARPENTER, director of sales and advertising, the Falk Corp., Milwaukee, has been elected executive vice president and director. Mr. Carpenter is a native of Milwaukee and received his early education there and further training at the University of Wisconsin, Madison, Wis. He has been associated with the Falk Corp. for the past 16 years, starting in the advertising department and serving successively as advertising manager, sales promotion manager, sales manager, and secretary and director of sales. He will continue as active director of sales and advertising in addition.

EAGER FOR ACTION!

No. 276-J Osborn Jolt Squeezer Molding Machine.

Every detail of the improved Osborn No. 276-J Jolt Squeezer is designed to help the moulder maintain fast production of high quality moulds with a minimum of effort.

Jolt and vibrator valves have non-skid, shock absorbing rubber cushions for knee operation. *Valves* are bronze, angle-seat construction.

The *squeeze head adjustment* makes it easy to change to different flask heights.

The *streamlined head* sheds sand and dirt thereby protecting the head bearings and insuring longer life of the machine.

Larger Yoke Pins of hardened and ground steel provide more than double the former bearing area and are equipped with replaceable steel bushings.

The new No. 276-J has a table size of 17″ x 26″; a 13″ squeeze cylinder diameter; and a 4″ jolt cylinder diameter.

The new No. 276-J Jolt Squeezer has the same important advantages as the No. 275-J Jolt Squeezer introduced a few months ago.

Complete information will be furnished promptly upon request.

THE OSBORN MANUFACTURING COMPANY
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Agencies located strategically all over the world

★

THE IMPROVED NO. 276-J JOLT SQUEEZER

OSBORN

MOULDING MACHINES

THE ADVENTURES OF BILL

By PAT DWYER

Drawings By RICHEY

THIS here now Solomon lad," Bill remarked as we sat on the front porch in the langorous dusk of a summer night, "this here Solomon lad could add one more to his famous list of puzzlers if he had flourished around these parts during the past deckit, deecayed or deekaid—take your choice—I never am sure myself how to pronounce that word—well, anyway, as I was saying he could have improved on that say of his. Maybe I am mistaken in this surmise, but if I was not feeling so lazy and comfortable, and if the night was not so hot, and if I was not essentially a man of peace who abhors arguments of any kind, I might go a little deeper into the subject. For instance the autocratic old bird might not have looked with favor upon any person who presumed to change his phrase by so much as a jot or tittle. By the way, how much *is* a jot or tittle?

"I knew a fella one time, a printer who set type by hand on the weekly paper. Used to wear an apron, probably white when he started to serve his time, but which through natural accretion of ink, grease, sweat and one thing and another over a period of years, became as hard and stiff as a piece of boiler plate and as black as your hat. I guess these printers' aprons never wear out. Must be the same kind of stuff in them as there was in the old leather britches from the famous Irish comeall ye of the same name. This printer told me that authors of misspelled and ungrammatical poems, letters to the editor, hand bills, dodgers, notices of auction sales and all that kind of junk, would come into the print shop frothing at the mouth if the editor, printer or proof reader touched a word, a letter or a punctuation mark in their precious copy. Do you know I often have wondered if writing stuff makes some people nutty, or if these people write stuff because they are nutty."

He thrust out his chin, cocked his head slightly to one side and looked so much like a parrot we had one time that I had to laugh. Head down and hanging by one claw from a swinging perch in his cage this hoary old villain—obviously I am referring to the parrot—would screech 'Help! Help!' at the top of his voice. After a few performances, members of the family paid no attention, but if a startled visitor or stranger approached the cage, Nicodemus, the little feathered friend, would whirl upright and roguishly half close one eye after the manner of an eighteenth century belle coquetishly protesting 'La, now, ain't I the one!'

"Listening to you," I said, "is enough to make any person nutty, a vulgar expression cruelly distorted in recent years from a true and legitimate meaning. However, since this not a clinic we shall ditch the subject for the time being and take up one or two points raised by the worthy brother under the heading 'Good and Welfare of the Organization! The brother memtioned Solomon. Just to keep the record straight, perhaps the worthy brother kindly will explain whether he meant King Solomon who had a fresh shirt and a new wife every day in the year, including leap year; old Solomon Levi, who according to an ancient college song kept a shop on Salem street, tral-a-lal-a-la-lala-la

Printer upholds power of the press

or Solomon Grundy, the gent who was born on Monday, christened on Tuesday, married on Wednesday, divorced on Thursday, died on Friday, waked on Saturday and buried on Sunday and that was the end of Solomon Grundy. To be repeated, as the old band score cards indicated *ad lib*, which meant until your own or the listener's patience wore out. Hearing no objection, the brother now has the floor."

"And about time," Bill said, "if you ask me. As a member in good standing, dues fully paid up I resent these here now steam roller tactics by which I am prevented from saying a word now and again. Only one Solomon in the book so far as I am concerned. I see no reason for dragging in your second hand clothing friend, or the other fly by night gent who popped on the scene and who popped out again in a week like old bottle nose Tim McNally who never worked more than a week in any shop. I remember one night in the old Oil Works in Ansonia—"

"The brother kindly will confine himself to the point at issue, a quotation I believe from the works of the first original Solomon. A rather fancy dresser according to all accounts, but not quite as smooth and slick and gorgeous in all his glory as the lilies of the field. Did quite a bit of writing, but where he found the time with a flock of women over running the place, under foot and in his hair, always has been a mystery to me. What particular gem from his nib's literary garden did you have in mind when you came to the surface a few minutes ago?"

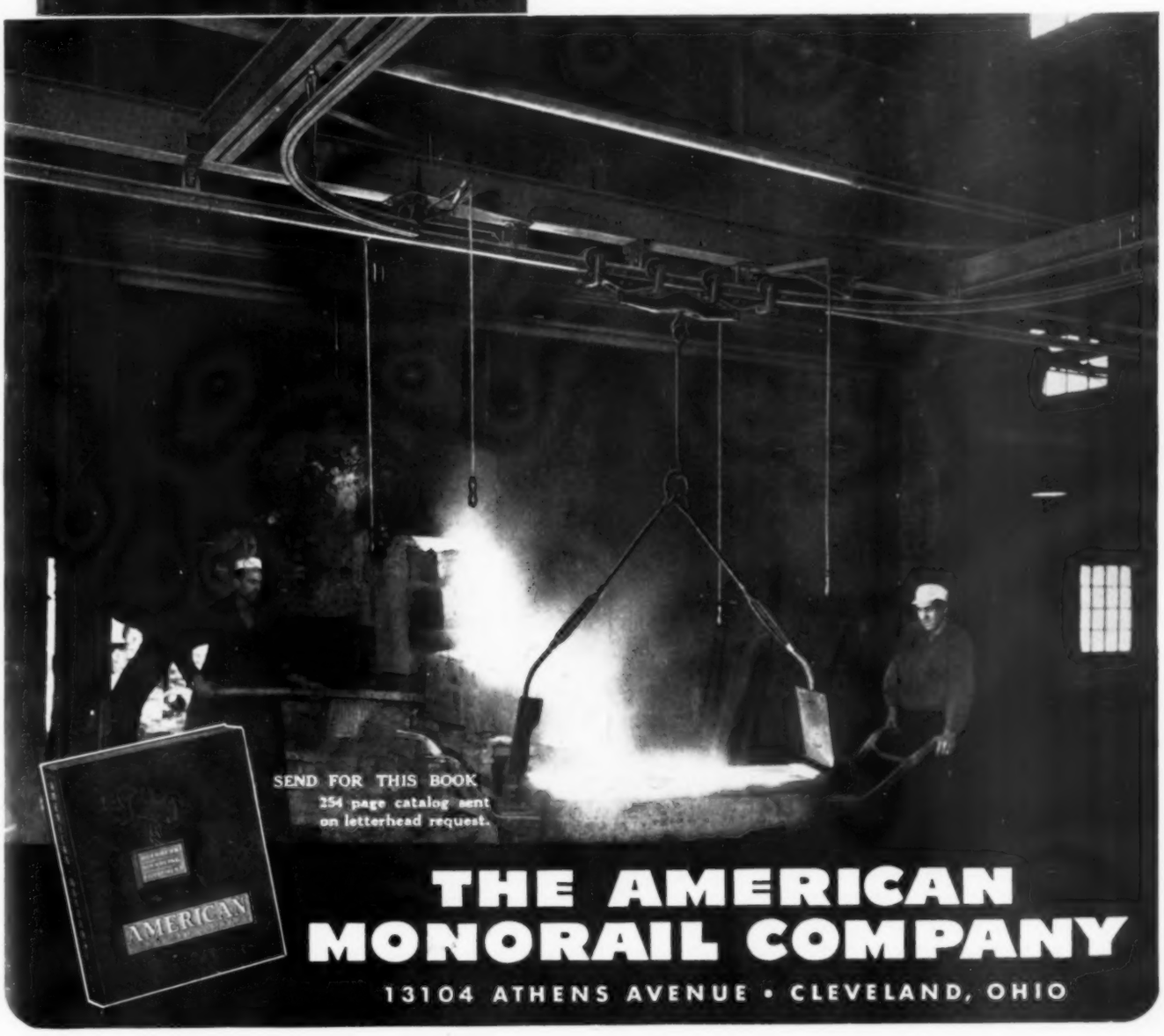
"The one about the eagle in the air, the serpent on the rock and the ship at sea."

"Read it a hundred times. Proverbs, chapter 30, verses 18 and 19. 'There are three things which are too wonderful for me. Yea, four which I know not: The way of an eagle in the air; the way of a serpent upon a rock; the way of a ship in the midst of the sea; and the way of a man with a maiden.' He may have been sincere enough in

(*Continued on page* 56)

Charge or Tap with MonoRail

Foundry profits often depend upon the cost of handling materials to and from the cupola, the "bottleneck" of production. Here is where MonoRail charging and tapping equipment shows immediate results in the way of lower costs or improved production, often large enough to amortize its cost. American MonoRail engineers are able, from their wide experience, to reveal hidden possibilities for improved foundry operation. Their services are available without cost.



ADVERTISING PAGES REMOVED

(*Continued from page* 54)

admitting ignorance on the first three items, but I think the old boy had his tongue in his cheek when he added in the fourth item, the maiden. He had approximately 1000 of 'em on his pay roll, and probably as many more on his prospect list."

"Reminds me," said Bill, "of the remark credited to the large colored lady when she first learned of Solomon's harem. She rolled her eyes and threw up her hands 'My, my,' said she, '300 wives and 700 concubines! De' weh real men in dem days!' "

"Last remark totally irrelevant and therefore stricken from the record. Kindly stick to the eagle, the serpent and the ship in the midst of the sea. That is enough for one day. Let the women take care of themselves. They can do it better than you or any other person."

"Well," said Bill, "I'll tell you. I heard a fella using the quotation. Afterward I wondered whether old Sol was in earnest, or just kidding the help, or maybe the thing is intended for one of them there alleganies or allygories. The poor gink probably was sick of the whole business. He envied the serpent which could dart in any direction without asking permission from any person. He wished he was an eagle, a bird which followed its own sweet will and did not have to explain the why, where and when of any journey. To an inland king who never had seen, felt or tasted salt water, the vision of a ship in the wastes of the sea represented a perfect haven of refuge. If he had lived in this present century he would have added one more item to the list of things he could not understand. He He would have marveled at the ease and speed with which men fly through the air."

"Why should he marvel? People now think no more of traveling by plane than they do of stepping into a train or automobile."

"Listen," Bill said, "Every night at 3 minutes of 8 a big plane flies over my house. First a faint sound like that made by a bumble bee, gradually growing louder and louder as the plane swings into view high in the eastern sky. From the front porch or from a certain window I have an unobstructed view while the moving object increases in size, accelerates in speed and sounds like a giant board going through a planer. In a few seconds it is directly overhead with the roaring propellers dragging it at incredible speed to the West. The noise gradually dies away and ceases altogether before the small moving speck disappears from ordinary vision."

"So what?"

"So what. I'll tell you so what. What becomes of 'em all? Every night for the past two months an animated siren comes out of the East and disappears in the West. Up to the present I never have seen one flying in the opposite direction. The only way I can figure it out is that several planes follow each other at 24-hour intervals and fly completely around the globe. At an average speed of 300 miles per hour and with a few stops here and there for oil, gas and water the trip of approximately 24,000 miles in this northern latitude could be made in 4 days."

"You don't need the wisdom of Solomon," I said, "to figure that one out. The planes fly East at various hours of the day while you are rooting around in the foundry where you could not hear them if they swooped low enough to knock the hood off the cupola."

"That would be a new one," Bill said, "for the melter to add to his list of excuses for poor iron. Can't you hear the honest lad's squawk: 'What do you expect? Hard enough to make good iron out of the scrofulous and lousy scrap you push off on me. I got to draw the line somewhere, ain't I? I can't melt no cueblow shells nor no bonnets offa the tops of no old cueblow stacks.'

"That reminds me of an inquiry I had the other day from a man who is melting approximately 8500 pounds per day in a 30-inch cupola. Each charge is 500 pounds pig iron and 500 pounds with 100 pounds coke and a few handfuls of oyster shells. Analysis of the iron shows: Silicon 2.00 per cent, phosphorus 0.40 per cent, sulphur 0.09 per cent, manganese 0.66 per cent, graphitic carbon 3.04 per cent, combined carbon 0.44 per cent. Tensile strength is 2800 pounds per square inch. Majority of the castings are subjected to pressure test and range in weight from 1 to 1000 pounds and in thickness from 3/16 to 1½ inches. When iron is tapped into the ladle it is clean and quiet, but shortly afterward great quantities of dirt rise to the surface. He finds small gas holes under the skin of the castings on the cope and drag side. He experimented with his core and facing sands, but without effect.

"In a reply I pointed out that several items in the inquiry seem to indicate that the iron is impregnated with slag which flows into the ladle with the iron in a fluid state and then rises to the surface either as a solid or a thick, viscid substance. The inquirer did not state whether the stream runs continuously from the tap hole, or is stopped either regularly or intermittently. Where the stream runs continuously, the metal should not be drained entirely

"In an alternative method a skimming reservoir can be maintained in

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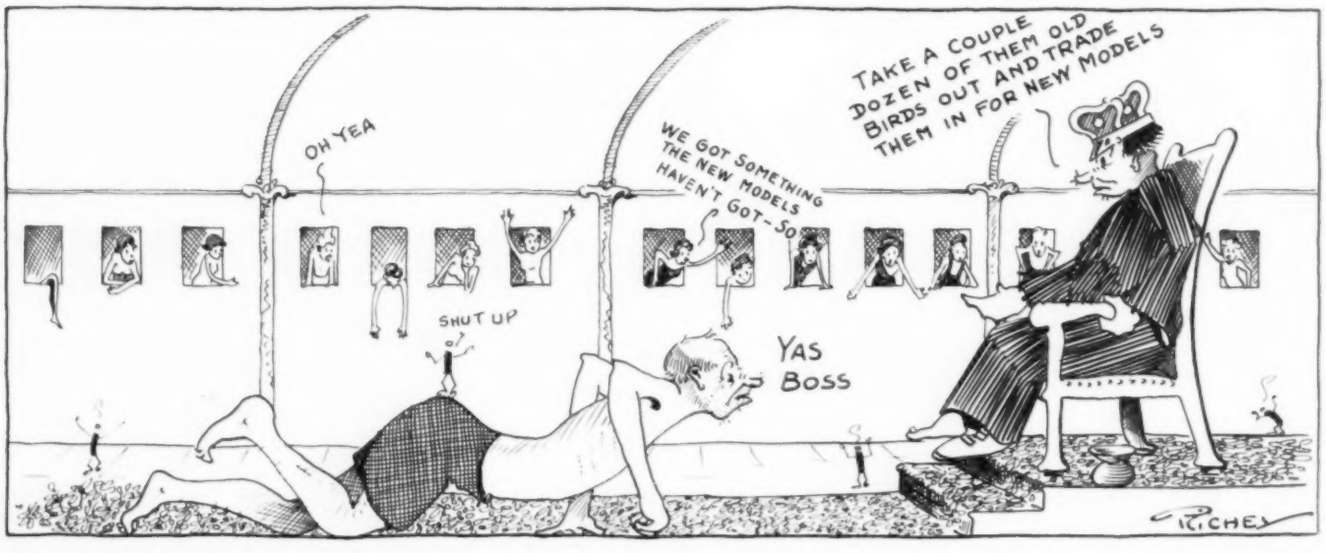

OH YEA
SHUT UP
WE GOT SOMETHING THE NEW MODELS HAVEN'T GOT-SO
YAS BOSS
TAKE A COUPLE DOZEN OF THEM OLD BIRDS OUT AND TRADE THEM IN FOR NEW MODELS
RICHEY

The king was in his counting house counting out his honies—counting them out the window

(*Concluded from page 56*)

a special spout where the metal flows under a bridge and the slag flows over or through an opening in the side. The subject of skimming spouts and cupola slagging was covered in detail in two articles in The Foundry, one in Nov., 1936 and the other in Nov., 1937. If the metal is tapped at regular intervals the stream should be stopped before the well is drained. That is before slag comes with the iron, or air commences to blow through the tap hole.

"I also ventured to point out that his cupola practice varied to some extent from the ordinary. With the heavy charges and minimum amount of fluxing material—a few handfuls of oyster shells—I should anticipate a rather heavy bridge at the end of the heat, entailing considerable work chipping it out on the following morning. With a smaller charge, say 500 pounds iron, 60 pounds coke and a shovelful of oyster shells or limestone, the metal should melt faster and cleaner. The bottom should drop clean at the end of the heat and leave very little material clinging to the lining.

"It is possible of course to run a cupola without a slag hole on short heats, but even on heats of 1 or 1½ hours, a slag hole will prove a convenience. The slag may be tapped at regular intervals, or allowed to flow continuously. I also wondered how he produced castings from 3/16 to 1½ inches in thickness from the grade of iron shown. Satisfactory enough for the thicker sections, I should expect to find it very hard in the thin sections."

"Do not look at me," I said, "I do not know the answer."

"No," said Bill. "And I do not believe Solomon did either!"

HOLDS CRANE ROPES From Bridge Conductors

By F. L. Spangler

A LARGE foundry that formerly ruined quite a number of wire ropes on cranes through allowing ropes to arc against the lower conductor on the bridge girder, devised a means of protecting ropes from such accidents by installing a vertical ⅜-inch steel plate between the rope and the trolley collector post. This plate is 14 inches long, 12 inches high and is attached to the bottom of the trolley spreader by a 3 x 3-inch angle. The plate is riveted to the angle and then the angle is bolted to the under side of the box-type spreader.

Grounding of the hoist rope onto the bottom bridge conductor generally occurred on the overhead bucket cranes, when the bucket was being lowered onto a pile of sand. The bucket would sometimes slide down the side of the pile in a direction that would slant the rope toward the bridge girder carrying the conductors. This angle of tilt at times was sufficient to cause the rope to touch a conductor, thereby producing an arc that would burn one or more strands of the rope. A rope so damaged is of no further use, unless the ends might be salvaged after the damaged section has been cut out. Naturally, a crane must be reroped after every accident of this nature, and if a rope is not immediately available the crane is forced to stand idle awaiting the arrival of the new rope.

Rope damage from this cause is likely to occur especially when the bucket is in or near its lowest position, since the rope then is near the end of the drum and ordinarily would be nearest to the bridge conductors, so that only a small lateral movement of the bucket will bring the rope against the bottom conductor. Since the installation of these steel plate guards, the foundry experiencing the difficulty has not experienced a single case of grounding of crane rope against the crane wiring.

Time Loss Is Serious

Where cranes are engaged in work vital to plant production, loss of crane time may be a serious matter. Under such circumstances, it is important that the maintenance crew get the old rope off and the new one installed as speedily as possible. Use of preformed rope will save time in that operation, since it does not require the application of seizings at the ends. Its ease of handling facilitates its application to the drum and its reeving through the blocks and sheaves.

Where sheaves and drums are small, longer life of preformed rope also is a factor. Since this rope is manufactured with all strands preset to the exact helical shape they have in the finished rope, it is not necessary to force these strands around the rope center in the closing operation of making the rope. These strands lie naturally in their final position without the presence of internal stresses that tend to make the ends fly apart and ravel when the rope is cut or that make the rope rotate when it passes over sheaves.

Metals Group Plans Western Congress

American Society for Metals has announced that the Western Metal congress and the Western Metal exposition will be held in Los Angeles the week of May 19, 1941. This will be the fourth congress and exposition sponsored by the A.S.M. previous meetings being held in 1929, 1931 and 1938. A committee of the Los Angeles chapter of the A.S.M. headed by A. G. Zima, International Nickel Co., is arranging local details. The exposition will be held in the Pan American auditorium.

Book Review

Elastic Properties of Nonferrous Metals and Alloys: Collected Data, by J. McKeown and E. D. Ward, cloth, 70 pages constituting 35 sheets, 12¼ x 9¾ inches, published by the British Nonferrous Metals, Research association, London, England.

Information presented in this book, which is in the form of tables and graphs, has been gathered from a large mass of published material, and from the association's own research. Published material before inclusion was subjected to a critical examination to meet a high standard of fullest details on composition, condition as tested including the form, method of production, and sensitivity of the strain measuring apparatus employed. The greater part of the data given have been obtained from tensile tests. Elastic data from torsion and bending or more complex tests have not been included.

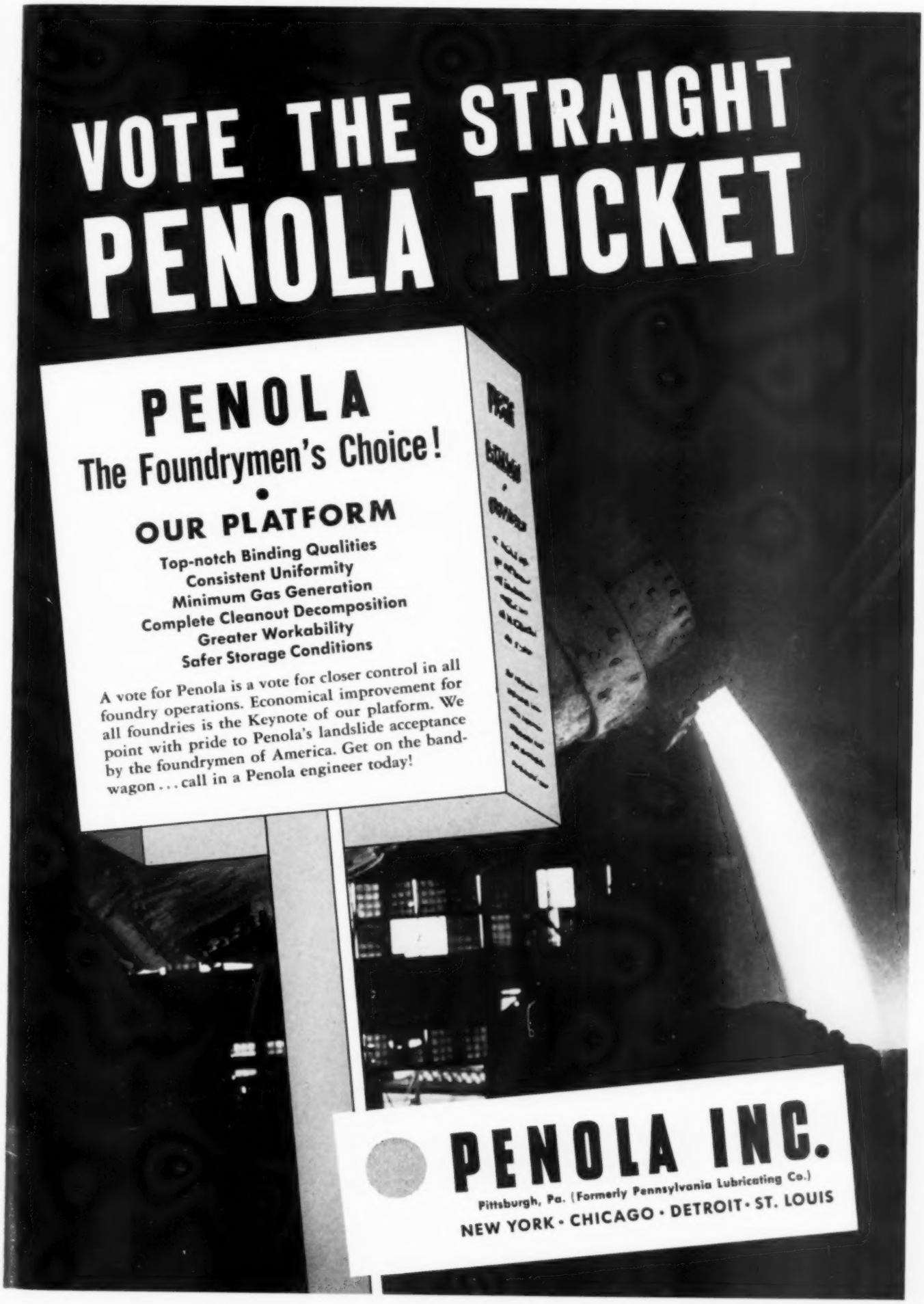
In addition to elastic properties, in many cases information on ultimate tensile strength and elongation is given. The metals and alloys are divided into 4 groups with numerous subgroupings, and include: Copper and its alloys; nickel, cupronickels, and nickel alloys; light metals, and gold, silver and platinum group metals. All told 219 metals and alloys are tabulated, and the volume includes literature references from which the data were obtained, and an index.

Wisconsin

ANNUAL golf tournament and dinner of the Wisconsin Chapter of the A.F.A., was held at the Ozaukee Country club, July 19. The golf tournament committee under the chairmanship of John Bing, A. P. Green Fire Brick Co., added another record to the Wisconsin chapter's long list. Attendance of 420 was well taken care of and every one enjoyed the good dinner and excellent floor show and entertainment. Several golf prizes were presented to those who played the fine course. In addition, 280 door prizes were presented to those holding lucky numbers. The foundry suppliers were responsible for the large number of prizes. One of the features of the evening was the

(*Continued on page* 62)

Fifth annual golf tournament and dinner of the Wisconsin chapter was well attended. The recently elected mayor of Milwaukee is shown in the center of the center illustration. Photographs courtesy Sterling Farmer, Sand Products Corp., Cleveland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(*Continued from page* 60)
presentation of the President's cup to past president, Roy W. Jacobs, Standard Brass Works, Milwaukee, 1938, by Ben Claffey, General Malleable Corp., Waukesha, Wis., present president—*H. C. Waldron, secretary.*

Twin City

ANNUAL meeting of the Twin City Foundrymen's association was held May 20 at the St. Anthony Commercial club, Minneapolis. The following are the officers elected for the coming year: President, Fred Kaim, chemical engineer and metallurgist, Union Brass & Metal Foundry Co., Bayport, Minn; secretary-treasurer, O. W. Potter, professor, University of Minnesota, Minneapolis. Executive committee, S. V. Wood, Minneapolis Electric

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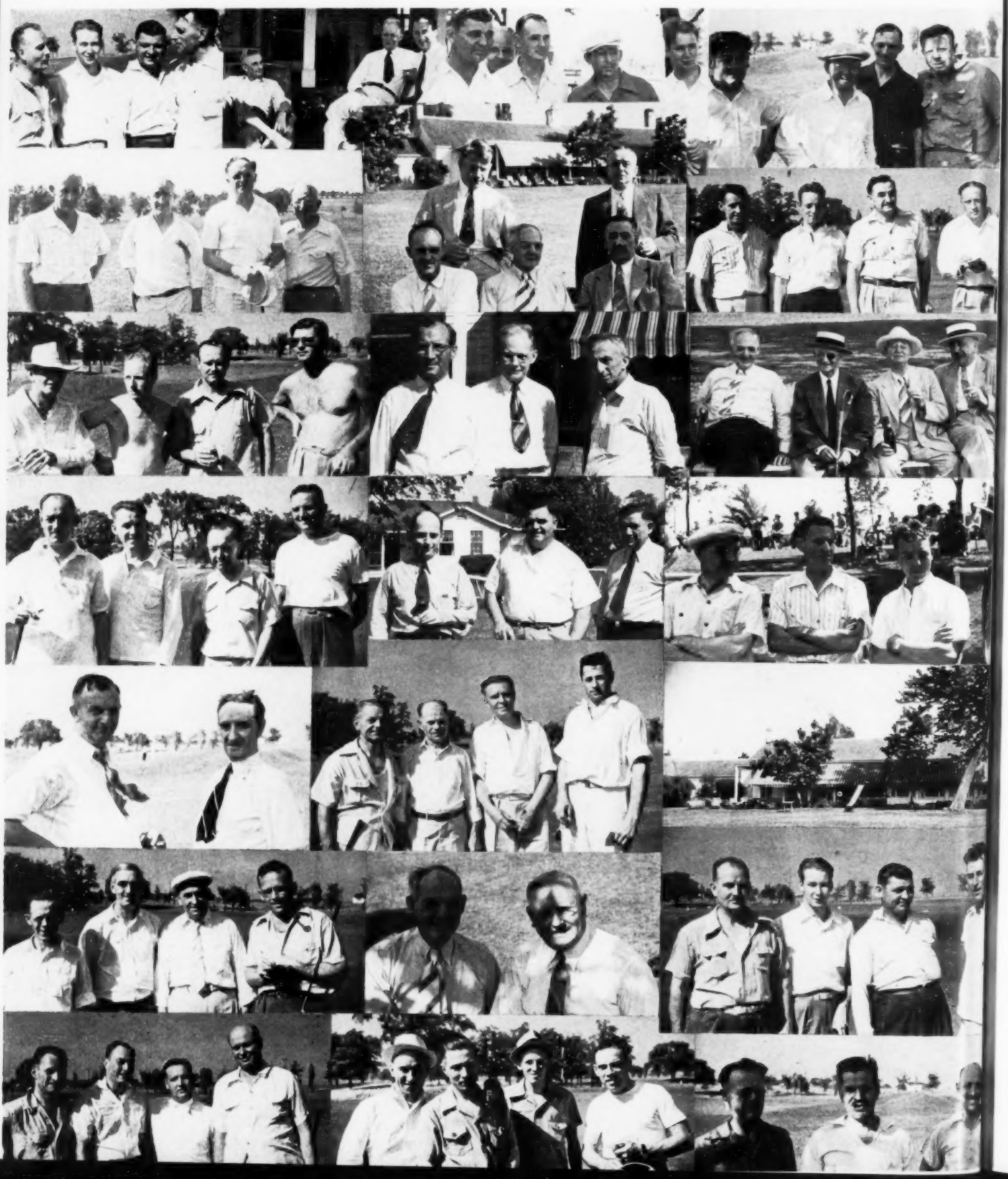
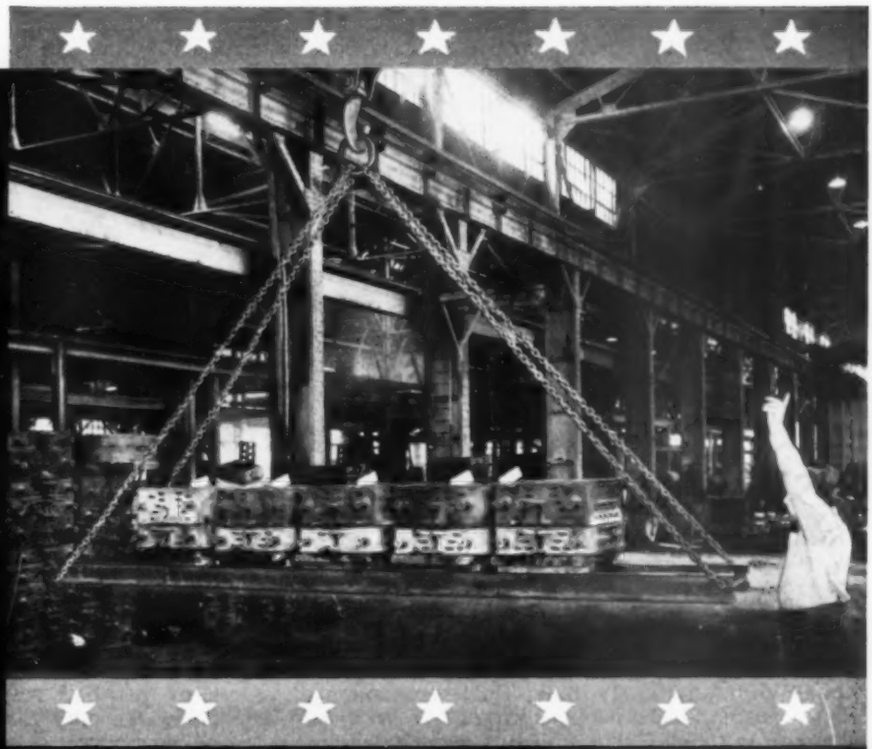
An interesting group of photographs taken at the Wisconsin chapter outing by John Bing, A. P. Green Fire Brick Co., Milwaukee



for the pre-paredness campaign



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Steel Castings Co., Minneapolis; Frederick Christensen, R. R. Howell Mfg. Co., St. Paul; vice president, E. C. Madson, manager, Andersen & Co., Minneapolis; J. W. Bryant, Northern Foundry Co., Minneapolis; E. H. Ryan, St. Paul Brass Foundry Co., St. Paul; Stuart L. Cameron, Valley Iron Works, St. Paul; G. L. Ashton, St. Paul Foundry Co., St. Paul; E. C. Madson, Andersen Foundry Co., Bayport, Minn.

W. F. Piper, Beardsley & Piper Co., Chicago, was the principal speaker, and he gave a lecture and showed pictures on his trip through Alaska.—*O. W. Potter, secretary-treasurer.*

Southern California

THIRD annual stag picnic of the Southern California chapter was held at the Lakewood country club, Long Beach, Calif., with more than 275 foundrymen and their friends present. The afternoon was taken up with golf, baseball, horse shoe pitching, races, and a futile effort on the part of many of the boys to ride "Bonzo" Hollywood's trained mule. During the dinner, the althletic and door prizes were awarded, followed by a fine vaudeville show.—*W. F. Haggman, secretary.*

Wisconsin Chapter Plans Regional

Fourth annual regional foundry conference of the Wisconsin chapter of the A. F. A. will be held at the Schroeder hotel, Milwaukee, on Thursday and Friday, Feb. 20 and 21, 1941. These dates and formal plans for the conference were decided upon at a meeting of the conference committee meeting in Milwaukee Aug. 9.

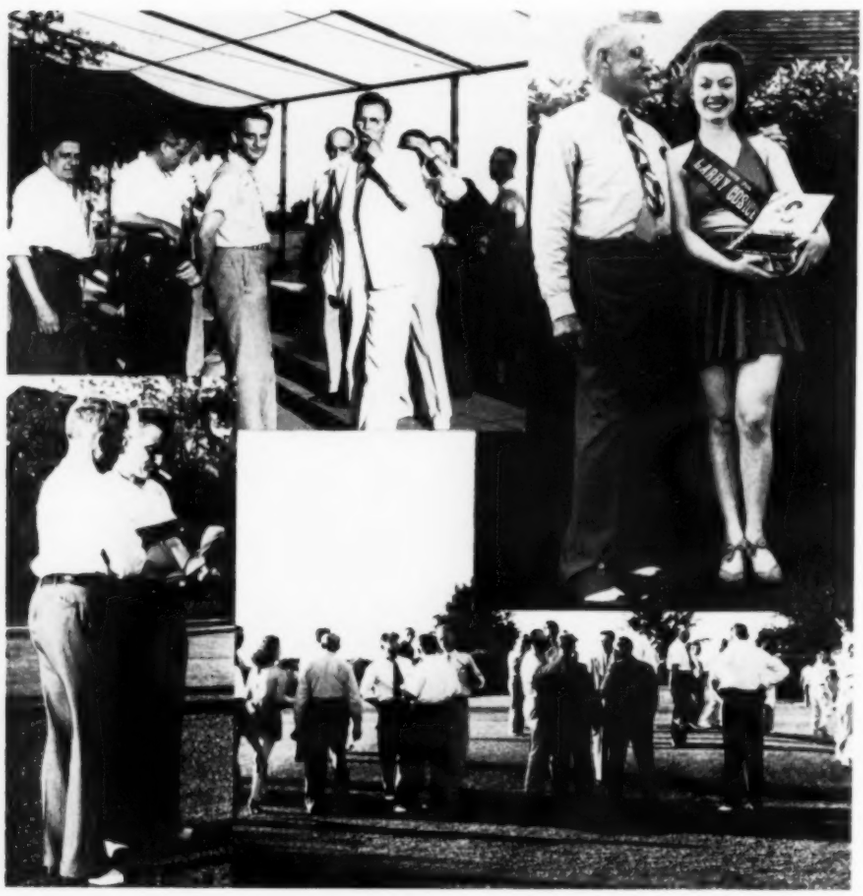
Two sectional sessions in gray iron, malleable, steel and nonferrous problems will be held each morning and afternoon of the conference, with a luncheon served at the hotel each noon. The evening of the first day of the conference a dinner will be held at the hotel, following the afternoon sessions, for which an outstanding program is being planned.

The sectional chairmen are: Harry Ladwig, gray iron; Charles Gutenkunst, malleable; Paul Powers, steel; and Walter Edens, nonferrous.

The conference committee comprises A. C. Ziebell, chairman; Prof. J. F. Oesterle, Ben D. Claffey, David Zuege, R. F. Jordan, Harry Ladwig, Charles A. Gutenkunst, Paul Power, Walter Edens, George M. Pendergast, Roy M. Jacobs, William J. MacNeill, Walter Gerlinger, George Dreher, T. E. Ward, Howard Waldron, Harry Donald, Prof. E. R. Shorey, Ray Flansburg, John Bing, James Ewens, Fred Pritzlaff.

The subcommittee chairmen are: George Dreher, speakers; George M. Pendergast, publicity; Roy M. Jacobs, arrangements; William MacNeill, registration; Walter Gerlinger, head table management; Ben D. Claffey, entertainment.

The conference committee anticipates an attendance in excess of 500. Final arrangements for the programs of both sectional sessions and luncheons will be made at a meeting of the committee on Sept. 27.



The Cincinnati District Chapter of A.F.A. held its annual picnic on June 19. The young lady distributed cigars on behalf of L. A. Gosinger's successful campaign for treasurer. Photographs by Howard Noakes, Cincinnati Milling Machine Co.

Gray Iron Founders To Hold Meeting

Gray Iron Founders' Society Inc., Cleveland, will hold its 1940 annual meeting at the Hotel Cleveland, Cleveland, at 10 a.m., Thursday, Sept. 12.

The meeting will be devoted to reports of activities of the society during the past year, and to the discussion of plans for meeting the problems of rearmament and co-operating with the various branches of the federal government in furthering that program.

All gray iron foundry executives are invited to attend, according to W. W. Rose, executive vice president.

To Hold Symposium On Refractories

A symposium on acid, basic and neutral refractories will be held under the auspices of the Chicago section, American Ceramic society, and the department of ceramic engineering, University of Illinois, on Friday evening, Sept. 20, at 7:30 p.m. in the auditorium of the Chicago Lighting institute, Civic Opera bulding, Wacker drive, Chicago. Dr. Robert B. Sosman, research laboratory, U. S. Steel Corp. Kearney, N. J., will discuss, "Temperature vs. Refractories." W. F. Rochow, Harbison-Walker Refractories Co., Pittsburgh, will present a paper on, "Service Application of Acid Refractories." Discussion of service applications of basic refractories will be presented by R. P Heuer, General Refractories Co., Philadelphia.

FOUNDRY DEVELOPMENTS AT SHORT RANGE

APPEARANCE of a slag from the cupola will provide an excellent indication of melting conditions. If considerable slag wool is formed, it means hot melting—also that the slag hole is too high. If slag is green, solid and glassy, it indicates good melting practice—green color being due to lower iron oxides. Light brown with yellow tinge and glassy slag shows good melting practice with manganese on the high side—and may cause hardness in small castings. Deep brown to black and solid slag means large quantities of iron oxide. Brown or black, and foamy or frothy slag indicates excessive oxidation, too low a bed, too high blast or too little limestone. Remedy is to increase coke and limestone. Slag with dull, stony fracture means too much limestone. White slag shows too much limestone is eating out lining. Slag with purplish tinge, solid fracture shows charge high in sulphur and slag is desulphurizing. Metal shot in slag indicates too high a blast or cold melting.

* * *

Metal for pouring alloy steel rolls in an open-hearth foundry is tapped into one bottom pour ladle and then transferred from the first ladle to a second ladle which is employed for actually delivering the metal to the mold. The object is to secure as nearly as possible a uniform and homogenous mixture.

* * *

Two recently developed processes are concerned with the protection of iron and steel against oxidation and scaling at elevated temperatures. In one a paint composed of a pigment, made up of refractory metallic oxides in a suitable vehicle, is employed. After application the paint is allowed to dry for about an hour, and then the painted parts are heated in a furnace for not less than 1 hour at 1600 to 1750 degrees Fahr. The other process involves coating the parts with aluminum by spraying with a metallizing gun, and then heat treating to promote alloying part of the aluminum with the iron or steel base.

* * *

The man wheeling barrow loads of sand from a pile outside the door had to open and close the door twice for each barrow load. The men on the inside protested loudly when the weather was cold. Peace was restored when a hole was cut in the wall beside the door and a piece of 12-inch pipe about 2 feet in length was inserted at a slight angle. Now the man on the outside pitches sand through the pipe hole. The man on the inside wheels it away. The coremakers have no grievance and the management no longer is faced with a sitdown or walkout protest. Was it not Sir Joshua Reynolds who said, "Trifles make perfection, and perfection—ah, perfection is no trifle."

* * *

AIR drying of green sand molds used for large steel castings for periods in excess of 60 hours affects their physical properties disadvantageously. However, skin drying with a torch nullifies the deteriorating effects of setting or drying time. Specimens air dried for 120 hours and then torch dried, have physical values equal to those dried 1 hour at 225 degrees Fahr.

* * *

To produce a high quality gray cast iron suitable for sand cast and chill cast rolls, chilled plates, and high duty applications a duplexing process is proposed in a recent patent. Part of the charge is melted in an air furnace, open hearth or electric furnace whereby the carbon can be reduced 0.20 to 0.50 per cent, and the metal can be heated substantially above its regular pouring temperature. Remainder of the charge is melted in a cupola to obtain a high carbon-high silicon composition. After melting, suitable proportions of the two are mixed to give the final desired composition. It is claimed that by the described procedure the graphite in the final iron is controlled to give a uniform and finer dispersion, that a fine grain structure is obtained, and that a fine and uniform pearlitic structure results.

* * *

IN THE case of brass castings which are to be plated, much labor can be saved if the permeability of the sand is held between 12 and 30 depending upon the weight of the castings. That permits the gas generated to flow away rapidly, and the molten metal to penetrate the sand slightly. That eliminates pinholes which are difficult to remove by polishing. The slight roughness caused by ample permeability, may be polished off easily.

* * *

In a Middle-west steel foundry where the core sand was prepared in a revolving pan mill of the type employed extensively at one time in all steel foundries, the mixing time was reduced appreciatively when a skip hoist and concrete mixing barrel were added to the device. The mixing barrel reclaimed from the scrap pile was mounted above the pan. Measured amount of sand and binder is loaded into the hoist at the floor level. The load is lifted and discharged into the revolving barrel driven through a simple gear arrangement. In this manner the load gets a preliminary dry mixing for a short period. When the batch of mixed sand is discharged from the pan, the barrel is tipped and the load of new sand is dropped into the pan. It is claimed that the batches of sand are mixed more thoroughly and in much less time than formerly.

DETROIT AMONG FOUNDRIES

By A. H. ALLEN
Detroit Editor, The Foundry

FORTY-SEVEN days (May 22-July 8) was all the time required to complete a million-dollar expansion and modernization program at the foundry of Pontiac Motor division. Essential details of this work were outlined in THE FOUNDRY for July, construction being delayed a month because of last-minute additions to 1940 model schedules. So strong was demand for new cars in June and early July that Pontiac could have moved another 15,000, but the 1941 program had to be started and assemblies had to be brought to a close.

Pontiac production in August got off to a flying start, with 10,000 of the 1941 models run off after one of the shortest changeover periods in the company's history. September production is slated to approximate 22,000 and with the August output represents a 100 per cent gain over the same two months last year. Concentrating on getting cars into the field, Pontiac has even suspended the customary preview of new models for press representatives this year. New models feature torpedo styling throughout the line, with six or eight-cylinder engines interchangeable on the same chassis.

Getting back to the foundry department, daily output of iron has been stepped up from 550 to 785 tons per day, with addition of two new cupolas of 27 tons per hour capacity each—96-inch shells lined down to 72 inches.

Data on Foundry

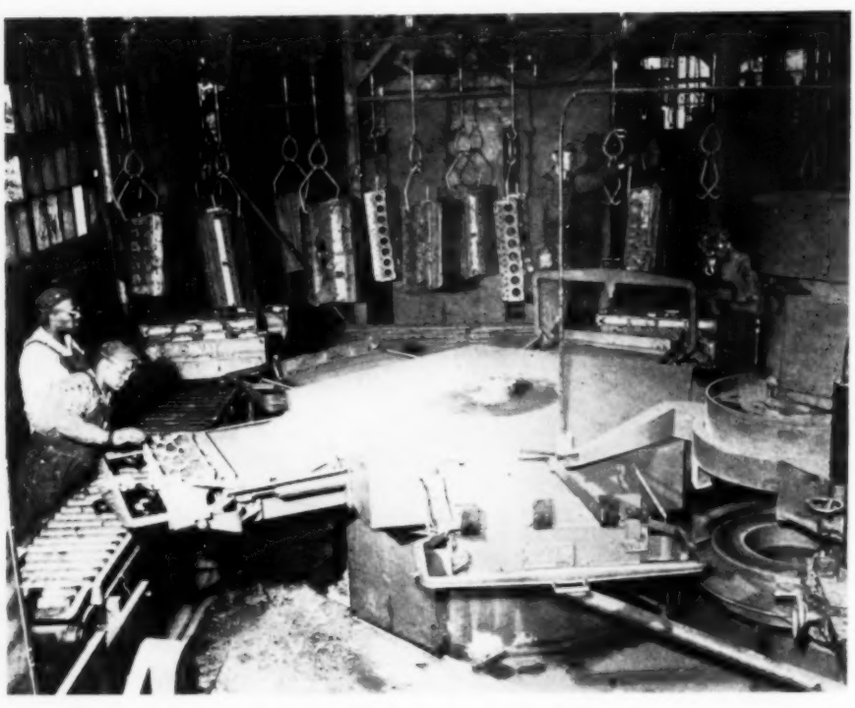
Recent visit to the foundry for inspection of equipment improvements by this writer found the staff too busy to see callers. Hence comment here is taken and revised from releases issued by Pontiac publicity representatives.

Renovations start at the railroad siding where grates have been placed beneath the tracks. Thus sand may be dumped directly from gondola cars and 50 tons of sand may be handled compared to the 10 tons per hour possible under the old method. As the sand falls through the grating beneath the cars it is fed by an apron conveyor to a new drier which operates at 1500 degrees, the heat being supplied by a new oil furnace. The drier has a capacity of 400 tons every 8 hours. When the sand reaches a bone-dry temperature of 140 degrees, specimens being taken every quarter-hour, it is passed over a screen and goes to the storage bins. (This appears to be an identical installation with the core sand drier installed at the Buick foundry and described in detail in THE FOUNDRY for May).

Thirty-seven hundred square feet have been added to the foundry proper in addition to the new sand handling facilities. At Pontiac the slag, as it comes from the cupolas, is carried away by a conveyor belt, immersed in water and then carried directly to the dump. Economy is exemplified in two new briquet machines which press cast iron chips into 11-pound bricks which conveniently can be melted for re-use.

Two new 75-ton an hour sand mixers have been installed for molding sand preparation. Four new vertical baking ovens bring Pontiac's battery of core ovens to 25. Four new mills have been installed for cleaning castings and are constructed so that castings may be rolled out when clean.

An automatic shakeout machine has been installed to handle motor blocks as they pass through on a conveyor. Last step is a new automatic grinder for milling the tops and bottoms of the motor blocks. The blocks pass under and over the grinders on a "merry-go-round" conveyor and the setup raises capacity from 120 to 350 blocks per hour.



Grinding top and bottom faces of cylinder block castings at a rate of 350 per hour on new merry-go-round equipment installed in Pontiac foundry. Grinding wheels are at right

Grind Cylinder Tops

An accompanying illustration shows the latter equipment. Close inspection of the photograph reveals one clue which partly explains the foundry expansion. On a fixture in the foreground is a metal tag reading "Olds 6," indicating production of these cylinder blocks is now being handled at Pontiac instead of Buick as was the case last year. On top of this are the greatly increased requirements of the Detroit Transmission division of General Motors

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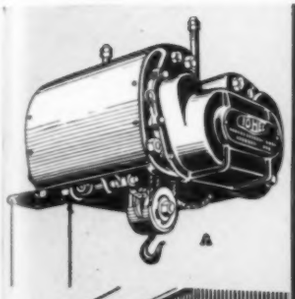

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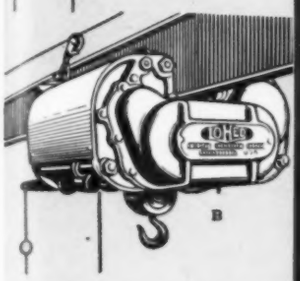

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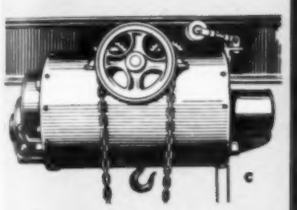

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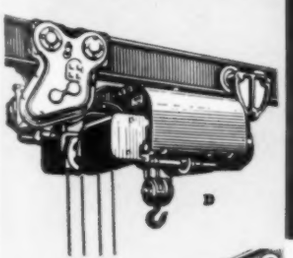

D

E

THERE'S A LO-HED ELECTRIC HOIST FOR EVERY PURPOSE

A—Bolt Suspension Type.
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C—Hand-Geared Type.
D—Motor Driven Trolley Type.
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CAPACITIES FROM ¼ to 12 TONS

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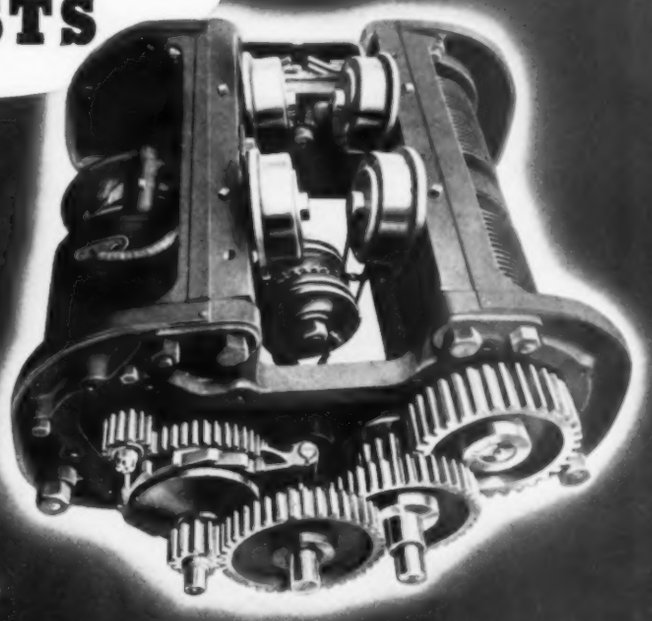
LO-HED *Time-tested* HOISTS



O.K. ON ANY TRACK

A hoist and the track on which it travels are partners for your profit. One should fit the other. That does not mean both must be made by the same manufacturer any more than an automobile tire must be made by an automobile manufacturer.

The Lo-Hed Hoist is built to run on standard I-beams or, with very slight modifications, on any track system. We make neither I-beams nor track systems. We believe that your ability to buy a hoist independent of the track is an advantage in shopping, in making track changes, or in switching the hoist location.

Get this time-tested advantage. While you're about it, look into all the other time-tested features of the Lo-Hed illustrated in the open-view of the Lo-Hed Hoist on this page: Heavy duty hoist type motor, automatic lowering brake, anti-friction bearings, stub tooth spur gears, plow-steel cable, 100% positive automatic upper limit stop, dust and moisture-proof controller. (Construction varies slightly for classes of Lo-Heds.)

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(*Concluded from page 68*)

for castings, and a projected 30 per cent increase in the 217,000 production achieved by Pontiac in the 1940 model season, so a 50 per cent increase in iron demand does not appear out of line.

The Hydra-Matic drive built by Detroit Transmission uses a cast iron housing. About 30,000 of these units were built for 1940 models, and Olds hopes to equip half its production in the next model year with the transmission, which would mean something like 100,000 housings.

Eight newspaper previews of new models were held last month—including Buick, Hudson, Plymouth, Willys, Nash, Studebaker, Olds and Packard. While not much can be said as yet of the new models, since these previews are private affairs and, while the cars are explained in detail to newspaper and magazine men, they are constrained from passing along the good word to their readers until such time as the official release, or "line story" as it is called, is made.

Bear Close Resemblance

Generally speaking, however, the new models bear a close family resemblance to their 1940 antecedents. Some stainless steel moldings have been added here and there, grille designs have been altered slightly, but no sharp deviations from the 1940's seem to have been made.

Studebaker, for example, has added another strip of stainless steel belt molding to the sides of the bodies of all models, has introduced a "slipstream land cruiser" model which follows closely the design of the torpedo body introduced on General Motors lines in 1940, has made minor increases in horsepower, overall length, body width, etc., but has introduced no mechanical changes of any great importance.

Similarly, Hudson has added wide belt moldings of stainless steel and has patterned the torpedo styling on certain models. To the average person, the 1941 models can scarcely be distinguished from their predecessors when viewed from the front.

New annealing furnace is being installed at the Saginaw Malleable Iron division of General Motors in connection with an expansion program necessitated by Chevrolet's change to camshaft of pearlitic malleable iron for 1941 models. Adoption of pearlitic malleable for these shafts is an important forward step in progress of this material which, under the aggressive sponsorship of W. H. Doerfner and Carl Joseph at Saginaw, has been making rapid strides in adaptation to automotive parts. Chevrolet camshafts have been of forged S. A. E. 1035 steel, rough ground, water quenched and finish ground.

Make Integral Casting

The day may not be far off when pearlitic malleable is accepted for crankshafts on some high-production car engine in the General Motors line, and then the heat will really be on the Saginaw division. Responsible foundry engineers and specialists see no reason why it would not be possible to cast a crankshaft integrally with the flywheel and realize important savings. Chief savings on the cast shaft are claimed to come from reduction in machining operations necessary.

Possibility that production of emergency-type shell lathes, involving unusual features from the foundry standpoint, will be initiated by the automotive industry is causing considerable behind-the-scenes discussion currently. Basic element of the proposal is the use of bed and frame castings which are cored out but not machined. By the use of elaborate locating and supporting jigs and fixtures, the ways—lengths of ground steel bars—and the bushings for headstock, tailstock, etc. which are machined tubes, are held in exact location in the rough cored holes in the main casting. Spaces between the cored holes and the inserts are sealed with clay at their ends and expanding alloy poured around the inserts, anchoring them in place in the rough casting. This alloy expands when it solidifies and provides a rather strong anchoring material, although its tensile strength is not much over 3000 pounds per square inch.

This type of lathe was made in large numbers during the last war, records showing that 68 per cent of all the shells of 6 inches diameter and larger made in the U. S. and Canada were turned on such machines. The system of locating was extended even to large planers with beds of reinforced concrete in which steel rails were anchored by expanding alloy.

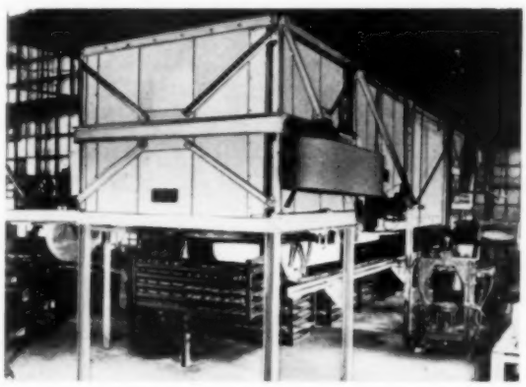
Studebaker currently is reported to be studying the possibility of producing such lathes in quantities running into the thousands. It is of interest to note that while essentially a machine tool, the equipment is being assembled in a plant not aligned with the machine tool industry.

A new corrosion resistant coating for readily oxidizable metals and alloys comprised of colloidal graphite, a hardenable organic colloid, and a hardening agent suspended in water, has been developed by a Midwestern firm. Coatings may be applied at normal or slightly elevated temperatures to promote drying by brushing, spraying, dipping, etc., and harden after application to the surface on exposure to artificial or natural light.

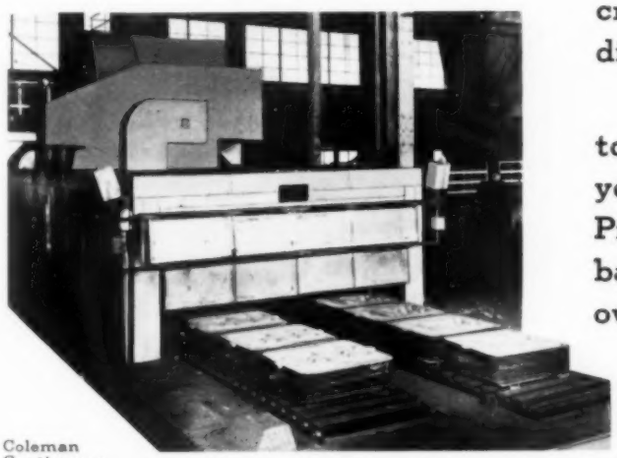
Buffalo Chapter holds a picnic. Below, left to right—W. J. Gill, Leo Geary, H. L. Davie, T. M. O'Brien, and A. Weston. Right—W. J. Corbett, Alec Rankin, and J. McCallum

Below, left to right—C. E. Weir, Henry Mumme, Jack Wark, Dan Kane, and Roy Wayne. Photographs courtesy R. K. Glass, Republic Steel Corp., Buffalo, N. Y.

Coleman CONVEYOR Type CORE OVENS



Coleman Double-Strand Horizontal Conveyor Oven at American Valve Co., Coxsackie, N. Y.



Coleman Continuous Mold Oven at Key Co., St. Louis, Mo.

For modern stream-lined core-baking, fast operation at lowest cost for labor and fuel, you should investigate Coleman Conveyor Ovens.

The planning of a conveyor core oven installation is a highly specialized job requiring engineering of the broadest experience and skill—each layout must be created to suit the individual operating conditions.

Coleman Oven Engineers will be glad to cooperate with you in the solution of your core and mold baking problems . . . Profit by their thirty-five years' experience, backed by a record of 5,000 successful core oven installations.

★ ★ ★

Coleman Ovens are also built in Portable, Rolling Drawer, Transrack, Car and other types.
For operation with any fuel that is economically available.

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THE FOUNDRY EQUIPMENT CO.
BUILDERS OF COLEMAN AND SWARTWOUT OVENS
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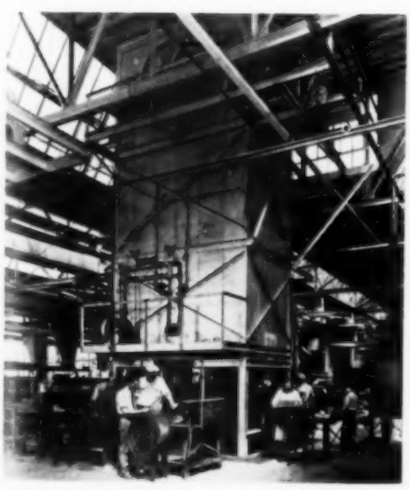
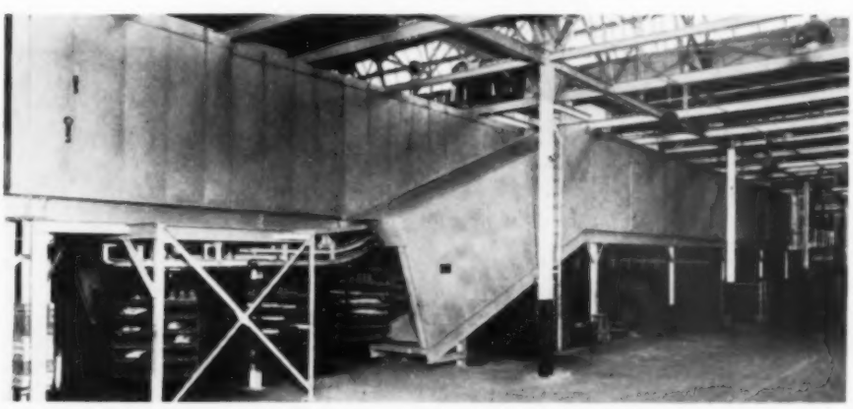


Coleman Tower Oven at Bendix Products Division, South Bend, Ind.



Typical Coleman Horizontal Conveyor Core Oven for large scale production.

COLEMAN
CORE AND MOLD OVENS

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Fig. 1—One end of the foundry at Purdue university, and a group of engineering students taking the foundry course

SHOP COURSES IN ENGINEERING SCHOOLS

By ROBERT E. WENDT
Foundry Instructor
Purdue University, Lafayette, Ind.

SCHOOL shop courses fall naturally into the following four different groups: General shop, manual training, trade and engineering. Each has a different aim, depending largely upon the type of work for which students are preparing themselves, and also upon equipment available for teaching.

General shop courses usually are of a very elementary nature, as given in small schools and mechanical art courses. Usually one teacher presents many different lines of shop work. Manual training or vocational courses generally are taught in high schools, and have two general aims. The first is to present to the students as many different kinds of shop work as possible in the limited time that can be given to any one subject. The second aim is to cause student to compart the different kinds of shop work, thus making him better able to choose the one in which he is most interested, or, in other words, determines the kind of work he will make his career. Such courses are often called *finding* courses.

After students have completed finding courses, they are given an opportunity to elect the work they like best, and then are given a more intensive training along the specialized line. Time spent on such courses varies greatly in different schools. The intensive course is to give students more knowledge and practice so that upon completion of the work they will have developed enough skill to enter a trade course with a higher rating, or to start on a job at a higher rate of pay than would be possible without the school shop training.

A very small percentage of students graduated from public schools, go on to higher educational institutions. According to the summary of the United States office of education, in 1934 less than 3 per cent of the population of the United States had graduated from college. Therefore, most young people have to go to work to make a living after leaving public schools.

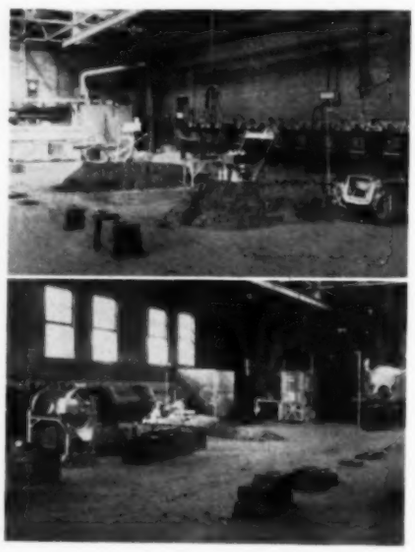

Fig. 2—Two views of equipment in the university foundry

Trade courses are planned with different purposes than either public school or engineering shop couses. A graduate from a trade course not only should have a fair knowledge of the trade, but also sufficient skill to enable him to do the job in the required time. Therefore, much more time must be given to trade courses than other shop courses. Amount of time needed to teach a trade, depends greatly on the trade to be mastered. Naturally some trades can be learned in less time than others. For example, the time required in learning the foundry trade, as recommended jointly by the A.F.A. and the Federal committee on apprentice training in foundries, is between 5000 and 6000 hours, while most of the public schools or engineering schools devote only from 48 to 190 hours to any one required shop course.

It is true schools have attempted to teach trades, but their efforts have resulted more or less in fail-

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(*Concluded from page* 72)

ures because of too short a time, or lack of proper equipment for teaching. Where industry and schools co-operate in teaching trades, the ventures have proven successful, especially such co-operation as practiced in Cleveland, Milwaukee, and other large centers.

Engineering shop courses should differ greatly from trade or high school courses. The engineering course should deal with the fundamentals involved and not with manual skill. Generally, in any shop course where knowledge of fundamentals, and not manual skill is the main factor, not as much time need be devoted to the subject as where manual skill is the main factor. One can learn the rules for playing baseball in a short time, but to be able to play the game, will require actual practice and lots of it.

Deals with Fundamentals

Shop courses in engineering schools should deal with fundamental principles involved in manufacturing processes, also with the nature of materials used. Therefore, they often are referred to as manufacturing process courses. The engineer usually designs machinery and engines, and specifies materials to be used. If metals are to be used, he should know the difference between rolled and cast metals; if cast metals are to be used, he should know the properties and applications of the different cast metals.

Engineers also should know different principles involved in manufacturing because the method used for making a model differs greatly from the method used in quantity production. Therefore, engineering shop courses should be so planned that they give essential information about materials used in engineering and manufacturing, thereby providing the young engineer with a good background for his work in designing and selecting materials.

When preparing engineering shop courses, all lectures, problems and jobs given to students, should have a definite application in engineering or manufacturing. When a job or problem has a definite use, the student takes much more interest. Engineering shop courses also should touch on all principles involved in manufacturing, and should include problems of management, engineering, metallurgy, labor and cost. While it is true that the time usually allowed for shop courses in engineering schools is far too short for all that should be covered, nevertheless, a well planned course can include many more principles and cover much more ground than a poorly planned one.

Among educators who have been consulted in regard to teaching shop work, there seem to be difference of opinion regarding just how shop courses should be taught in engineering schools. These schools of thought can be put into three general classes.

First, in early years, shop courses dealt only with making the job, and very little attention was paid to the why's, how's, and when's. That line of thought is disappearing, although a few still cling to it.

Make Inspection Trips

Second, some believe shop courses can be taught on paper, and by lectures only. Students make inspection trips throught commercial shops in place of using shop laboratories. Such methods have some advantages, but many disadvantages.

Third, some believe a well balanced short course should have lectures dealing with the why's, how's and when's in manufacturing, and the nature of materials likely to be used. A laboratory should be used and the student given a little practice so that he will understand better the significance of the lectures. Such knowledge should give a better understanding of the importance of correct designs.

After all is said and done, when planning shop courses there should be a good reason for each job, problem or lecture in the course. To quote from Sir Walter Scott, "When a man hasn't a reason for doing a thing, he has a good reason for letting it alone." That also holds good when teaching and planning shop work.

This article is from a paper presented at the annual Engineering Instructors' dinner held during one of the annual conventions of the A.F.A.—The Editors.

Book Review

Gmelins Handbook of Inorganic Chemistry, Iron Part A., Sections I and II, Divisions 1 *to* 9 (Gmelins Handbuch der anoranischen Chemie, Eisen Teil A, Abteilungen I und II, Lieferungen 1 zu 9), published by Verlag Chemie, G.m.b.H, Berlin, Germany.

These volumes in German constitute parts of an extensive compendium of information relating to iron. Data presented are in three volumes of which sections I and II form two, and division 9 forms another. Sections I and II are indexes giving abbreviated and complete titles of publications from which abstracts have been taken, subject and chapter indexes. Section I lists historical, metallurgy of iron and steel, corrosion and passivity of pure and carbon-bearing iron. Section II lists the system iron with sulphur to tantalum, carbon steels, freezing, after treatments, surface hardening, and properties.

Volume entitled division 9 discusses a number of systems containing iron and other elements beginning with iron-magnesium and ending with iron-protactinium. Elements with iron include, calcium, strontium, barium, zinc, aluminum, titanium, mercury, zirconium, tin, lead, vanadium, tantalum, etc.

Will Hold Forum

The fifth annual forum of the Porcelain Enamel institute will be held October 16 to 18 at the University of Illinois, Urbana, Ill.

Time Study Clinic

The 1940 National Time and Motion Study clinic staged by the Industrial Management society, will be held at the Chicago Towers club, Chicago, Nov. 8 and 9.

Fig. 3—A variety of castings are produced by engineering students in the Purdue foundry

WAUKESHA FOUNDRY HOLDS OPEN HOUSE

By JOHN E. HUBEL

CELEBRATING the completion of a new machine shop and office building, the Waukesha Foundry Co., Waukesha, Wis., 18 miles west of Milwaukee, held open house early this year for 550 customers, salesmen, executives and others from a wide territory. From 9 a.m. to midnight the visitors enjoyed tours of the plant, good food and general refreshments, friendliness and general hospitality. Many of those in attendance had been doing business with the company since it was organized more than 30 years ago, with a capital of $4200 and in a little building 40 x 50 feet. The present plant covers an area of 65,000 square feet. Products include brass, bronze, aluminum in ordinary and special combinations including a nickel alloy corrosion resistance metal. Arrangements have been completed for the production of stainless steel products.

Ten years ago the company began the manufacture of sanitary pumps for use in the carbonated beverage, ice cream, dairy, canning and other food industries. Variety of pumps is so wide it is claimed the pumps will operate on any fluid or semifluid that will flow through a tube. A year ago this branch of the business outgrew the capacity of the machine shop. The new machine shop and office building 85 x 130 feet, erected at a cost of $50,000 is the largest of the many extensions to the plant during the past 30 year period.

The general offices at the front of the building, modernistic in design are air conditioned throughout and equipped with the latest and most efficient shadowless lighting method. The front wall of the building is limestone. Rear and side walls are concrete. Plans are practically completed for a new aluminum foundry 65 x 225 feet to be erected during the coming year.

Book Review

48 *Million Horses*, by Humphrey B. Neill, 241 pages, published by J. B. Lippincott Co., 227 South Sixth street, Philadelphia.

This book is the story of the rapid progress in the development of electricity since Thomas Edison opened the first central station in New York in 1882 to the present time. The story is presented in nontechnical terms for the information and education of the reader unacquainted with the various terms of kilowatts and ohms.

Interested groups view foundry open house. Photos by O'Brien, Waukesha

Mr. Foundryman . .

HERE IS A LABORATORY FOR YOU!

NOT a department bristling with beakers and graduates, bunsen burners and microscopes, and manned by linen-coated specialists in research—not at all. Important as those aspects are, the laboratory we offer you strikes more directly at the end of placing pleasant-looking figures on your ledgers.

Production must march! National conditions—world conditions—demand it. But, not to generalize too much: HOW ABOUT YOUR FOUNDRY? Have your molding methods advanced definitely as compared with a year ago? Do your castings have better finish and greater salability? Is your scrap pile smaller than it was twelve months ago? Have you overcome variations in size and weight? *Are you making more money than a year ago?*

Customers report that we have assisted them materially in these directions. In typical instances their molding costs have been lowered as much as 50%, scrap has decreased in the same ratio, and output per man has jumped as much as 150%. Foundries have achieved these results by *using SPO as their laboratory.* We put your job through its paces in our plant, and give you the right answer as to what molding equipment you need *and do not need.*

SPO designs and builds both molding machines and pattern equipment, and guarantees them to produce castings which will be in accordance with your specifications. Our promises are based upon our own wide experience as foundrymen; and we stay with every installation until it performs exactly as we say it will. *A SPO engineer awaits your call.*

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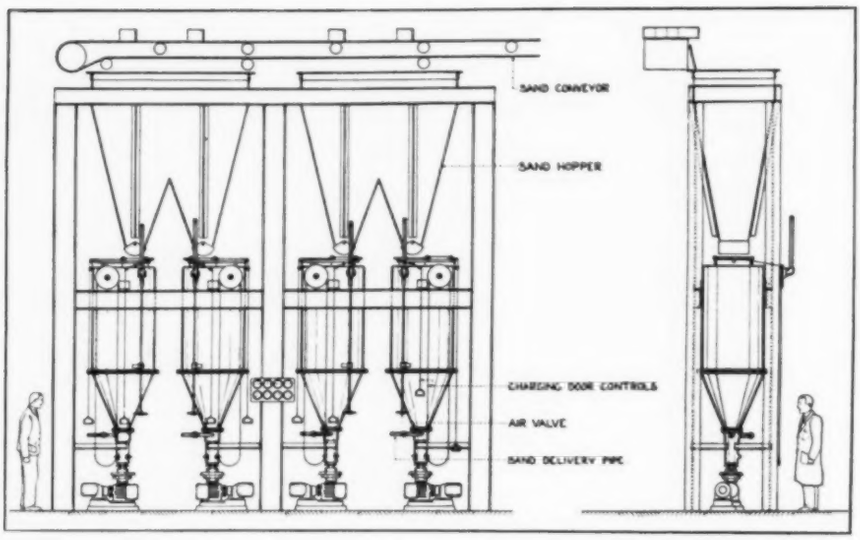

Fig. 1—Generators where molding sand is mixed with compressed air before being sent to the molding stations

BLOWS MOLDING SAND INTO MOLDS

INTERESTING results are claimed for a system of sand-conveying and mold making developed in Great Britain over a period of 3 years.

The plant consists of a generator, Fig. 1, where molding sand is mixed with compressed air, and from which it travels along ordinary small diameter steel tube to the molding station. An articulated tubular arm flexibly holds the delivery end of the sand conveying tube, Fig. 2, while the molder directs the stream of sand into the molding box. The delivery end of the sand pipe is moved horizontally over the box till the stream of sand has filled it. Sand enters the boxes at a speed and under conditions which, it is claimed, produce molds as uniformly hard along the sides of the deepest lifts as on horizontal surfaces, and of somewhat unusual permeability.

Molding boxes and patterns required for the process are of any ordinary type. Gaggers or other irons may be placed in the sand as in hand-molding while the sand stream is stopped temporarily if necessary. Even should several minutes elapse between shutting off the sand stream and starting again on the same mold, no cleavage is traceable between early and later filling. Stripping the molds follows normal practice.

Traveling along the pipe to the molding station, it is believed the particles of sand are separated minutely from each other by expansion of the compressed air contained between the grains. When the intense rain of separated sand emerges from the delivery nozzle and beds itself in the molding box, it produces a mold containing a complex matrix of minute air channels within the sand.

The equipment can be used for all types and sizes of molds. Articulated arms at the molding station cover a large molding area, but they occupy little floor space.

Sand has been delivered successfully through 10 feet of 1½-inch diameter pipe connected by reducing socket to a 50-foot length of 1-inch diameter. The sand produced molds as excellently as with shorter lengths of pipe. It is believed that longer lengths could be used if desired. Wear and tear of the piping is said to be negligible. A further indication of the small friction present is that the speed at which the sand leaves the piping varies little whether the distance is 10 or 60 feet. Explanation appears to be that the sand travels forward in the pipe surrounded by air acting as an almost frictionless envelope. Air consumption for the process has not been measured definitely, but it appears to be approximately 225 cubic feet of free air per ton of sand. Pressure required is 70 to 90 pounds, dependent on the green strength of the sand.

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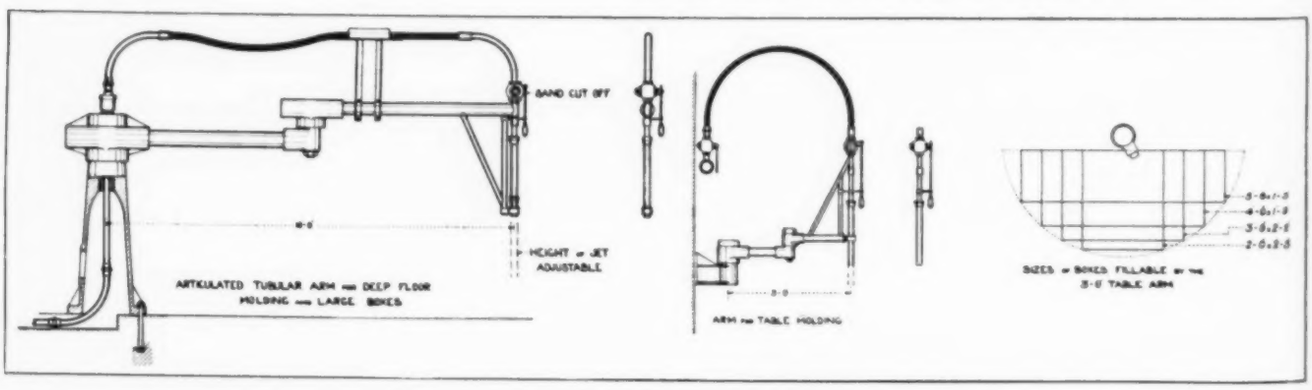
Fig. 2—At molding station the air-sand mixture is delivered into the molds through a flexible tube mounted on an articulated arm


SAND CUT OFF
HEIGHT OF JET ADJUSTABLE
ARTICULATED TUBULAR ARM FOR DEEP FLOOR MOLDING OF LARGE BOXES
ARM FOR TABLE MOLDING
SIZES OF BOXES FILLABLE BY THE 5'-0" TABLE ARM

NORTON SERVICE in the Foundry

Two Types of Abrasive—aluminum oxide (Alundum) and silicon carbide (Crystolon)—in several varieties provide the right cutting action for any type of casting—steel, gray iron, malleable iron or non-ferrous.

Two Types of Bond—vitrified for wheels operating up to 6000 s.f.p.m. and organic (such as resinoid and rubber) for high speed operation—meet the requirements of all kinds of grinders.

Several Special Treatments—patented lubricating fillers—are available for certain types of jobs to prevent metal from sticking to the cutting points.

Consulting Engineering—to make this variety of abrasives, bonds and treatments of maximum benefit to you there is a Norton man in your district ready to help in selecting cost-cutting wheels for your cleaning room. And back of him are the field specialists on foundry grinding and the engineering and research departments at Worcester. This is Norton Service for the foundry.

NORTON COMPANY, WORCESTER, MASS.

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NORTON ABRASIVES

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(*Concluded from page* 78)

The system also is said to be applicable in large core shops. Special core boxes are not necessary, and either oil or clay bonded sand can be used.

Just above the base of the inverted cone that forms the base of the generator an air belt distributes the compressed air through the sand. The compressed air serves the triple purpose of agitating and aerating the sand and propelling it under pressure into the distributing line. Air at 90 to 100 pounds per square inch is available, but a reducing valve brings down the pressure to the figure required in accordance with the nature of the sand and the hardness wanted for the mold. So far, the highest pressure used at the outlet nozzle has been 55 pounds. For steel castings, a pressure of 35 pounds has been used with synthetic sand.

In the conical part of the generator an agitator is rotated by an electric motor placed underneath the sand generator. This agitator mixes the sand with the air so that it may be carried away with the air, otherwise the air would bore a channel through the sand. After leaving the bottom part of the generator, the sand is propelled through ordinary 1½-inch steel piping, to the molding stations. So far, the sand has been carried to a useful distance of 60 feet.

At the molding station the sand passes through a flexible tube mounted on an articulated tubular arm. By opening a valve at the back of the electrically operated tubular arm, the sand is propelled by the compressed air into the outlet nozzle. The nozzles are interchangeable pieces of ordinary steel tubing of various lengths and diameters from 1 to 1½ inches. Distance from the extremity of the nozzle to the molding face can be adjusted, either by the articulated arm carrying the nozzle, or by a telescopic nozzle, or again by using nozzles of different lengths.

Capacity of a small plant ranges from 5 to 7 tons delivery per hour through a 1-inch outlet with a twin generator. Each unit has a capacity of about 3500 pounds and the two are emptied and refilled alternately. Generators are filled from a hopper, and the hoppers are fed from the sand preparation plant by a conveyor. Power required for the plant is 3 horsepower per ton of sand.

A recent demonstration the sand mixture was 2½ parts bentonite, 6 parts black sand and 1½ parts coarse silica sand. Permeability of sand in the mold was 120 and moisture about 5 per cent and satisfactory castings were produced.

Hardness of the mold can be controlled by the air pressure, size and position of the nozzle, and by the speed of traverse. Complete operation for filling a mold 6½ x 12 x 19 inches took half a minute by an operator who was not a professional molder.

Molding stations should be placed close to the generators to reduce the length of pipe and thereby reduce loss of power. Where the line exceeds 60 feet, it is advisable to install an additional generating plant. The system is claimed to be particularly well adapted to a circular or turntable layout.

METAL PENETRATED CORE IN LONG IRON ROLLER

RECENTLY a foreign foundryman submitted a problem which presents several interesting features. He wrote as follows: We cast a white iron roller 18 inches outside diameter, 4 feet 6 inches in length, with an opening in the center for a 3½-inch spindle. The hole is not to be machined, therefore it should not be any larger than necessary. We used a loam core and poured the casting on end. The metal penetrated the core into the barrel and we cannot remove the core from the casting. The core barrel is 1¾ inches in diameter, covered with the usual thickness of ½-inch grass rope and ¾-inch of loam for a total outside core diameter of 3⅜ inches. The loam is a mixture of molding sand, silica flour, core gum and fire clay. The core was quite hard and firm to resist pressure, but apparently was not too close since it did not blow during the casting process. We have six of these castings to make and on each of the remainder we propose to use a piece of steel pipe of the proper diameter, fill it with core sand and use this combination for a core. We should like to know if a loam core is less permeable than a sand core and if that is the reason for using a hay band, or, do we use ahay band because we always have used a hay band. To our mind a 1-inch thickness of loam on a suitable size barrel would be the safest kind of a core, but we never have seen a loam core without an underlying hay rope and we hesitate to try the experiment. We shall appreciate your solution for this problem which is bothering us.

Replying to this inquiry we pointed out that the proposed solution of the problem by the use of a piece of steel pipe, probably had enabled him to complete and ship and castings long before his letter had arrived and certainly a long time before our reply was delivered into his hands.

The first point which aroused our curiosity is why he should have to put a hole in the casting. What objection is there to placing a shaft or spindle in the mold and casting the roller around it? Is it that the spindle wears out and has to be replaced from time to time before the roller is scrapped? How is the spindle held in the roller?

Seems to us that 3½-inch diameter shaft wabbling around in 3⅜-inch hole would wear out rather rapidly. Casting steel shafts in the center of rollers is quite common practice. The bearing ends of the shaft are rough machined before the shaft is placed in the mold. After the casting is cleaned it is placed in the lathe and the bearing ends of the shaft are machined truly concentric with the circumference of the roller.

1—The casting was poured on end. Even under the most favorable conditions this imposes a severe strain on the lower part of the core. In addition to the high temperature maintained for a comparatively long period, the core is subjected to static pressure while the metal is liquid, and to contraction pressure while the metal is solidifying. You do not state what method of gating was employed, but it is only natural to assume that the casting was gated at the bottom. This is common practice and is to be commended under certain conditions. In the present instance it may be partially responsible for the metal entering the core. A bottom gate constantly introduces hot metal at one point until the mold is filled. The core at the bottom of the mold constantly is exposed to metal at the highest temperature. The metal in the vicinity of the core has no opportunity to cool and form a protective sheath around the sand. The proper method is to introduce a small amount of metal at the bottom to form a cushion, and then pour the remainder through a ring of small pop gates on top of the casting.

2—Metal penetrated the core and into the core barrel. Metal penetration of cores surrounded by a large mass of molten metal is a fairly common phenomenon, but the fact that the metal also penetrated the core barrel would seem to indicate that the core material was not sufficiently refractory. A better loam

(*Concluded on page* 83)

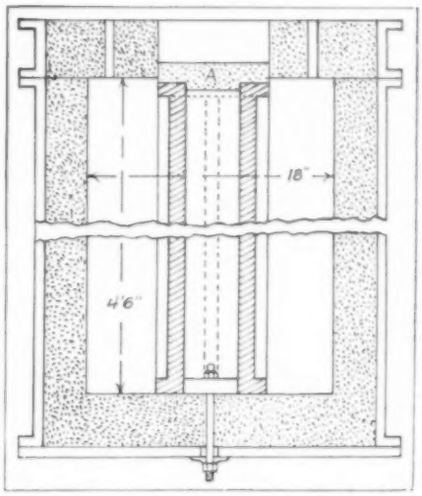
(*Concluded from page* 80)

mixture than the one you used would be 12 parts silica sand and 1 part fire clay. A core made of this mixture and coated with silica wash will stand up in severe service and resist penetration to a remarkable extent.

3—Under certain conditions the core may be reinforced on the outside by a coating of asbestos paper, by a thickness of hay wire wound in a continuous spiral from top to bottom, by a row of light steel rods surrounding the core and held in place with a few strands of wire, by a sheet of thin steel plate wrapped around the core. The object of course is to cool the metal and form a protective skin. Whether any of these devices would be permissible in your case is open to question, since the hole is not machined later. However, since you propose to use a steel pipe, the objection to a lining of this kind in the hole may not exist. The only possible objection would be that any lining material is not as hard as the casting, therefore it would wear away rapidly and give more clearance around the shaft.

4—In comparatively thin castings a steel pipe needs no filling to resist the heat and pressure of the molten metal. In the present instance where the pipe is surrounded by a large mass of molten metal for a long period, the pipe must be reinforced on the inside. Otherwise it will collapse to a greater or lesser extent. Some founders fill the pipe with water and keep a stream flowing through until the metal in the casting solidifies. Manifestly the casting must be gated in a manner that will promote initial solidification around the pipe. If a stream from a gate impinges on the pipe it will cut through with a resultant wreck of the mold and possible scalding of the workmen. Properly arranged and supervised the method is both safe and convenient. However, the more widely practiced method of reinforcing the pipe is to pack it full of thoroughly dried sharp sand without any binder. If for any reason it is desirable to fill the pipe with a core sand mixture containing a binding agent, it is advisable to incorporate saw dust in the mixture and also provide a liberal vent opening through the center. An opening also should be provided through the top and bottom prints so that a current of air will pass through the vent in the core and provide complete combustion of all combustible material.

5—Range of permeability in loam is as wide as the permeability of sand. In some types of natural loam the permeability is comparatively high. In a synthetic loam based on sand with a high clay content, the permeability is increased by the addition of a certain amount of combustible material, saw dust, chopped hay or straw, manure, etc. The hay rope is used for several reasons. First, it forms a foundation to which the loam will adhere better than it would to a bare barrel. Second, it forms a porous foundation for the loam, a ready exit for any gas or steam into the barrel. Third, the hay burns away and provides clearance for the ready extraction of the barrel from the casting. Fourth and most important in the majority of cases, the hay rope is the cushion that permits the casting to contract.



A cast iron sleeve is prepared in advance and placed in the mold for the roller

6—The following method involves slightly greater initial expense, but when the total cost is compared with others, we are inclined to the opinion that it is the cheapest. Certainly it is the most reliable. The accompanying illustration shows all the essential features. A cast iron sleeve, the same composition as the roller is prepared in advance and placed in the mold. This sleeve may be 1½ or 2 inches thick, flanged at both ends and provided with four longitudinal ribs to anchor it solidly in the casting. Obviously the sleeve easily may be molded in a horizontal position, and an ordinary core properly chaplated in the center will form a straight hole with a minimum amount of clearance for the shaft.

A bolt dropped through a hole in the cross bar at the bottom of the sleeve is secured with a nut under the bottom plate of the flask. This will hold the sleeve securely in place while permitting the natural expansion when the sleeve is surrounded by molten iron. The sleeve will expand approximately ½-inch, therefore in the cold state, the upper flange will be ½-inch under the cope of the mold. The dry sand core A is placed in the upper end of the sleeve and mnves upward in the print as the sleeve expands. Later with casting and sleeve at the same temperature, they contract uniformly. As a precautionary measure, to prevent the entrance of iron from any cause, the sleeve is filled with perfectly dry sand. The advantage of this method is that the whole is prepared in advance and placed in the mold. After the casting is shaken out, the loose sand runs out of the sleeve and the job is done. The sleeve needs no coating of any kind, but of course care must be taken to see that it is perfectly clean and perfectly dry so that the metal will lie against it quietly without any disturbance or agitation of any kind.

Melting Pot Used For Zinc Alloys

Alloy cast iron pot, which is said to give excellent service in melting zinc-base alloys containing aluminum, has 3.4 per cent carbon, 1.6 per cent silicon, 0.6 per cent manganese, 2.2 per cent nickel, and 1.1 per cent chromium. Before putting into service the pot is normalized for 10 hours at 750 degrees Fahr. and the foundry scale is not removed. A coating of rust is found to constitute a protection against attack of molten alloy, and in some cases it is desirable to accelerate rusting by outdoor storage and intermittent spraying with water. When first put into service, it is advisable to apply a thin wash of fire clay and water containing a small amount of sodium silicate.

Book Review

Operation Analysis, by Harold B. Maynard, and C. J. Stegemerten, cloth; 298 pages 6 x 9 inches; published by the McGraw-Hill Book Co., New York.

This book as the title indicates describes the procedure for conducting operation analyses. The authors claim that its application is inexpensive in comparison with the purchase of new equipment and once started it usually pays for itself many times over. Application of the procedure is not limited to trained technicians, but may be applied successfully by any industrial supervisor. The book should prove of interest to progressive men connected with the producing activities of any industrial enterprise as well as the serious student of the methods engineering procedure. Principles set forth are readily understandable to the practical shop man. Application of these principles is illustrated by numerous case examples presented in the text.

Abstracts

FROM WORLD FOUNDRY LITERATURE

Copper Alloys

Machining Properties of Copper Alloys, by W. B. Sallitt, *The Metal Industry*, London, England, Sept. 8, 1939.

While this article pertains to a large degree to copper-base alloys in the wrought form, many of the compositions mentioned also are available in the form of castings, and from that viewpoint may be of interest to those foundrymen who also do machining. The author classifies the various alloys into three types, which are homogeneous, duplex and leaded alloys, and discusses the characteristics of each. Turning to machining practice he describes briefly machine tools, cutting tools, speeds and feeds and cutting fluids. Final section of the article on copper alloys for machining purposes discusses lead additions, composition, grain size, elimination of distortion, etc.

Melting Furnace

A New Furnace for Melting Aluminum, by T. A. Booth, *The Metal Industry*, London, England, Feb. 16, 1940.

This article describes a new type of furnace developed for melting aluminum which employs radiant tubes in the molten bath to supply the heat. In a furnace holding approximately 1120 pounds 4 burners firing into U-tubes are used and it is claimed that it has an output of about 700 pounds per hour. Firing tubes are arranged so that they may be removed after the furnace is emptied for cleaning. While no information is given on composition of the tubes, mention is made that it is a special alloy which is not attacked by aluminum. If tubes are cleaned while hot, the adherent film brushes off easily without necessity of scraping. Town gas is used for melting and it is stated that overall figures for consumption show less than 2 cubic feet per pound of aluminum melted.

Cupola Melting of Iron

Cupola and the Melting of Iron, by L. F. Girardet, *Foundry Trade Journal*, London, England, Nov. 2, 1939.

In this article the author gives an interesting discussion of what takes place in melting iron in the cupola. He divides the cupola into four zones and describes what he believes occurs in each. First is the bottom zone or crucible; the second the oxidation zone, the third the reduction zone, and the fourth the preheating zone. Bottom zone extends from sand bottom to tuyere level. In discussing the coke beds the author states that it does not remain still but moves up and down, due to ferrostasic pressure and other factors. Oxidation zone extends from tuyeres up to region of maximum temperature which he says according to the principle of St. Claire Deville should be a depth ten times the average diameter of the pieces of coke.

Third or reduction zone extends from the top of the second zone to a point where the temperature is such that the reduction of CO_2 to CO is practically negligible or about 1000 degrees Cent. The fourth or preheating zone continues from the top of the third zone to the charging door. The third zone also is that of superheating. One of the interesting points he mentions is that due to more rapid rate of combustion, etc. at periphery of charge, descent of charges is such that movement is from center to outside. Hence, it is useless to arrange the charges with care since during descent the heavy pieces go to the outside, etc.

Normalizing Treatment

The Practical Application of Normalizing Treatments to Cast Iron (Applications Pratiques Aux Pieces en Fonte des Traitements de Stabilisation) by Guy Henon and Mlle. Renee Le Romancier, *La Fonte*, Paris, France, November-December, 1939.

In this paper the authors deal quite extensively with the practical phase of the normalizing treatment of cast iron, the article being illustrated with various types of industrial furnaces used for this purpose and employing electricity, solid, liquid or gaseous fuels. Some examples of the practical application of normalizing treatments to specific types of castings, such as, cylinder blocks, cylinder liners, cast wheels, etc., are also dealt with.

Enameling Defects

Enameling Defects Due to the Foundry (Defauts d'Emaillage dus a la Fonderie) by Ch. Dennery, *Bulletin* de l'Association Technique de Fonderie, Paris, France, Aug.-Sept., 1939.

The most common enameling defects may be due to the choice and nature of the enamel, and the choice and nature of the cast iron, or even both together. The author discusses the principal defects due to the foundry and divides those into four main classes:

1—Formation of blisters caused by the evolution of gases in the cast iron, and which tend to pass through the enamel coating. 2—Difficulty or impossibility of making the enamel adhere properly to the iron. 3—The permanent deformation which the cast iron may assume during the enameling operation. 4—Cracking of the enamel coating during or after enameling, due to internal stresses.

Ladle Additions

Ladle Additions to Cast Iron (Pfannenzusatze fur Gusseisen) by E. Piwowarsky, *Die Giesserei*, Duesseldorf, Germany, April 5, 1940.

With the increasing importance which attaches to the proper use and correct determination of the ladle additions to be made for the purpose of bringing out the best mechanical and physical properties of cast iron, the practical foundryman often is confronted with the question, as to what types of additions are already known, or have been successfully used or are protected by patent. With this in view, the author made a search of all the literature on the subject since 1900, to which he had access and compiled a table showing the most important ladle additions which have been proposed.

Obviously, the compilation cannot lay any claim to completeness, particularly since the expression "ladle additions" as regards its metallurgical meaning is hard to define with respect to those additions, which are made to cast iron purely for alloying purposes. In the narrower meaning of the word are therefore understood only such additions as have been used for deoxidizing, degassing or for influencing the crystallization processes (reduction or increase of the rate or time of crystallization), or the artificial increase of the nuclei-forming suspensions. Additions which aim at purely alloying reactions, as, for example, all additions made for producing alloyed cast iron in the heretofore usual sense, have been omitted from the table. The sources cited are articles from technical publications, U. S., French and German patents, together with the type of addition and the purpose of such an addition.

Nickel Cast Iron

Nickel Alloy Cast Iron, by W. G. Wright, *The Australasian Engineer*, Sydney, Australia, April 8, 1940.

The author presents a detailed discussion on the effect of nickel, nickel-chromium, and nickel-chromium-copper on cast iron. Numerous graphs and tables are included to show the effect of various additions on hardness, physical properties, corrosion resistance, growth, chill, etc.

Magnesium Alloys

Casting Magnesium Alloys, anonymous, *Canadian Metals and Metallurgical Industries*, Toronto, Ont., April 1940.

This article constitutes a report of a talk presented by Dr. W. F. Chubb at a meeting of the Ontario Chapter of the A.F.A. in which he discussed magnesium alloys, their molding and casting. Protection from oxidation during melting of magnesium alloys, and from moisture in the green sand molds are probably the most important points. Use of fluxes containing magnesium and potassium chlorides, and sodium and calcium flourides serve satisfactorily during melting while in the sand for molding, additions of various materials such as sulphur, ammonium flouride, sodium fluosilicate, boric acid, etc. provide either a neutral atmosphere or a film on the surface of the metal which prevent reaction with moisture in the sand. Sand for magnesium alloy castings must have high permeability. The alloy must be heated to at least 1500 degrees Fahr., and cooled to 1400 or 1450 degrees for pouring to insure a fine grain structure.

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Obituary

TAYLOR H. Boggis, 72, formerly head of the Taylor Boggis Foundry Co., Cleveland, died July 22 in his apartment at Hotel Alcazar. He retired from active business 5 years ago. The business was started by his grandfather in 1866 under the title Hovey, Taylor & Son and has continued down to the present. For many years the company operated two foundries, the original on West Third street in the old flats district and the other a more modern building on East 55th street. Several years ago these plants were closed and a new foundry erected on the property of the Consolidated Iron & Steel Co., Babbitt Road.

* * *

Augustus B. Nolte, 85, president and founder, Nolte Brass Foundry Co., Springfield, O., died July 11 at his home in that city.

* * *

E. H. Maytag, 56, chairman of the board of directors and president of the Maytag Co., Newton, Iowa, died July 20 at his summer home in Lake Geneva, Wis.

* * *

Thomas H. Stuart, 74, owner of the R. J. & T. H. Stuart Foundry, New Hamburg, N. Y., before his retirement, died at Wappingers Falls, N. Y., July 18.

* * *

Robert J. Hicks, foundry superintendent, General Metals Co., Los Angeles, died Aug. 7. Mr. Hicks had been associated with the General Metals for many years.

* * *

Samuel I. Horner, 72, for many years manager of the foundry of the Atlas Engine Works and the Midwest Engine Co., Indianapolis, died Aug. 4 at his home in Indianapolis. Mr. Horner also was connected with the Hoosier and the Kokomo Brass Works, Kokomo, and before his retirement 2 years ago, was manager of the Dill Foundry Co., Rushville, Ind. For many years Mr. Horner was a regular attendant at the annual conventions of the American Foundrymen's association.

* * *

William H. Woodhall, 47, metallurgist, Harrison Steel Castings Co., Attica, Ind., died July 19 at Indianapolis. Mr. Woodhall was born in Chicago and attended school at Attica, and Lewis institute, Chicago. From 1915 to 1918 he served as chemistry instructor at the high school of Woodstock, Ill., and from 1918 to 1920, held a similar position at Hastings, Nebr., as well as being city chemist. Graduating from Purdue university in 1922 as a chemical engineer, he became connected with the Harrison company as metallurgist.

* * *

George Leach, 55, president and founder, Pacific Ball Mfg. Co., Los Angeles, died in that city Aug. 1. Before coming to Los Angeles 9 years ago, Mr. Leach operated foundries in Portland, Ore., and the Leach Bros. Foundry in Seattle.

Reduces Breakage In Cleaning

By C. C. Herman

Anticipated production at the plant of the Pennsylvania Lawn Mower Works, Primos, Pa., for the present year will break recent records. In a highly competitive field production costs must be kept at the absolute minimum, consistent with high quality material and workmanship. The product in this instance is in keeping with the plant distinctive for beauty of setting, general order and repair.

Considerable part of a lawn mower is cast iron including side frames, wheels and pinions. Experience over a period of many years has resulted in the production of highly finished castings which reduce machining costs. Wheels with an internal gear are cast to such close limits and with such smooth surface that machining is eliminated.

Many lawn mower castings are relatively thin in section ranging from ⅛-inch upward. They are easily broken by ordinary cleaning methods. Average breakage amounted to 30 per cent when ordinary tumbling barrels were used. For that reason sandblasting was practiced for many years. Experiments were tried to obtain a more satisfactory low cost method of cleaning these thin section castings. Tumbling barrels lined with rubber 1-inch thick reduced the breakage about 10 per cent, but still the percentage remained too high.

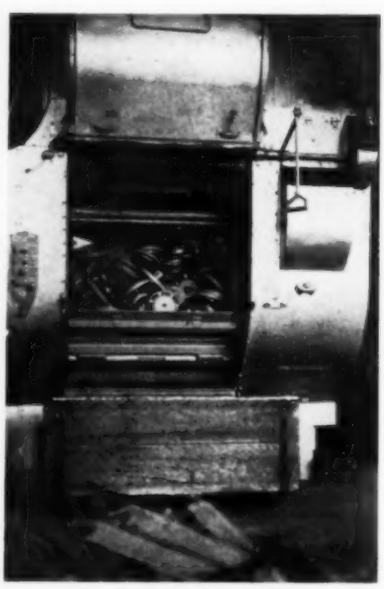

Fig. 1—Experiments in loading the barrel resulted in standard procedure

About 2 years ago the company installed the cleaning unit shown in Fig. 1, made by the Pangborn Corp., Hagerstown, Md. Breakage loss was reduced to under 5 per cent. This loss was reduced further by experimenting with different methods of loading the barrel. In the present standardized process a load consisting of 80 wheels and 70 side frames is cleaned in from 12 to 15 minutes without any breakage. It requires 7½ minutes to clean 150 internal gear wheels and about 20 minutes to thoroughly clean a load of 1200 cast pinions.

Fig. 2—Band saw permits removal of sprue close to the casting

A band saw for removing sprues from cast aluminum wheels is shown in Fig. 2. A hardened steel bushing is set in the mold and becomes an internal part of the wheel. In the mold the molten metal flows into the top of the hub through a sprue terminating in three small gates close to the steel bushing. In Fig. 2 the operator is shown removing the sprue close to the hub to leave the minimum thickness of metal to be turned off in subsequent machining operation. Interior of the cleaning room is painted white and the room is kept clean at all times by periodical brushing down.

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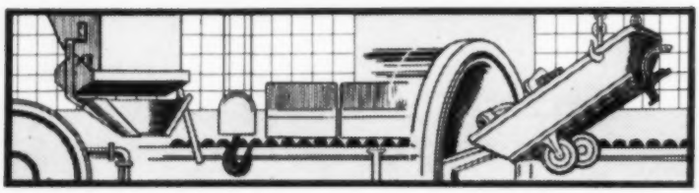
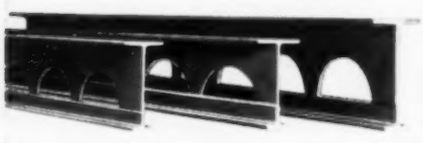
NEW EQUIPMENT



AND SUPPLIES

Overhead Rail

Cleveland Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., announces a new series of tramrail arch beam for overhead materials handling systems for



loads up to 5 tons. The new series includes three sizes: 12 inches deep, 28 pounds per foot; 12 inches deep, 33 pounds per foot; 15 inches deep, 50 pounds per foot. The new arch beam is a compound section, a wide flanged *T*-member to which is welded a specially rolled rail. The vertical member is arched at regular intervals, reducing weight without sacrificing strength. The wide top flange adds stiffness and prevents buckling. The special high carbon rail has a hard, flat raised tread which becomes highly polished in service assuring continued easy operation. The hard surface raised tread prevents peining down of the rail flanges. The beam is supported by a ball and socket swivel connection at the ceiling or superstructure and at the top of the beam flange. This free swing suspension it is claimed relieves tension stresses. As with the smaller sizes the new arch beam can be used either with hand operated or electrified systems. Various types of necessary switches have been developed.

Dust Collector

American Foundry Equipment Co., Mishawaka, Ind., recently has placed on the market a new high efficiency cyclone type dust collector, shown in the accompanying illustration. In operation the dust is separated from the air by centrifugal force. Unusually high efficiency is claimed for the new model. The air volume can be varied to a great extent without seriously affecting the efficiency. Dust hoppers and supports vary according to installation and may be supplied by the customer. Storage tanks may be of any size or design providing they will handle the anticipated volume of dust. Dust is not collected

or stored in the collector unit constructed of heavy gage metal to withstand the scouring action.

Air-Gas Valve

North American Mfg. Co., 2910 East 75th street, Cleveland, has developed an air-gas valve which is said to produce an air-gas mixture of constant proportion, making both fluids interdependent while passing through an aspirator and an atmospheric regulator respectively. The control valve has adjustable port which can be set to insure effective control of the air over the whole motor operating range with an external by-pass to supply air at blower pressure to an auxiliary diaphragm on the atmospheric regulator when the control motor goes to the shut off position. Force from the diaphragm closes off all gas flow to the burners at this point which is said to eliminate possible over-riding of temperatures at low temperature settings.

In operation part of the energy in the air stream aspirates the gas so that a fixed relationship is in existence at all times between the quantities of the two fluids flowing. To accomplish that the gas pressure is reduced to atmospheric within the device by means of a special regulator. In addition a number of rods of different diameters for varying the area of nozzle and throat of the aspirator are available so that by the simple process of substitution, a large degree of flexibility may be obtained.

Dust Suppressor

Faraday Engineering Co., 122 Whitfield street, has developed a dust and fume suppression unit, shown in the accompanying illustration. It is comprised of a hood containing a series of water jets or spray nozzles directed into venturi tubes which create a suction. The suction draws the dust laden air into the hood and through the venturi tubes. Vaned cones at the bottom of the tubes receive impingement of the water, air, dust and fumes, and mix them thoroughly it is claimed. Dirty water containing the solids is run to a settling sump or dewatering tank, and after

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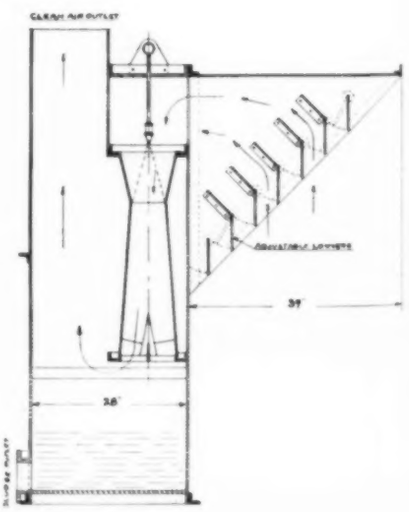


(*Continued from page* 88)

the solids are removed, the clean water is pumped through the nozzles again. It is said that each tube will handle 600 cubic feet of air per minute with a 50-pound per square inch pressure on the water jets. That produces the required 100 to 200 cubic feet per minute air velocity at the face of the hood. Adjustable louvres in the face of the hood permit varying the flow at any point.

Air Cleaner

Westinghouse Electric & Manufacturing Co., has redesigned its line of electrostatic air cleaning equipment for commercial and industrial application. Two sizes of cells have been adopted as standard. One cell has an effective cross section 8 inches wide, 18 inches in length with a cleaning capacity of 375 cubic feet of air per minute. The other cell 8 x 36 inches, has double this capacity. It is pointed out that with these two standard units an air cleaning system for any given layout may be constructed quickly and economically.

By the blackness test used by the National bureau of standards the larger cell is claimed to have an efficiency of 90 per cent at 600 cubic feet of air per minute and 85 per cent at 750 cubic feet per minute. The smaller cell is designed to be 90 per cent efficient at 300 cubic feet per minute and 85 per cent at 375 cubic feet of air per minute. Power packs are available in two standard sizes: One for installations of from 1 to 12 cells, 8 x 36 inches; the other for installations of from 12 to 50 cells of the same size. For larger installations, power packs are used according to capacity requirements. Each power pack includes a high reactance transformer, rectifier tubes, capacitor, indicating system and a cabinet to house the parts. Both types operate on 115 volt, single phase alternating current lines.

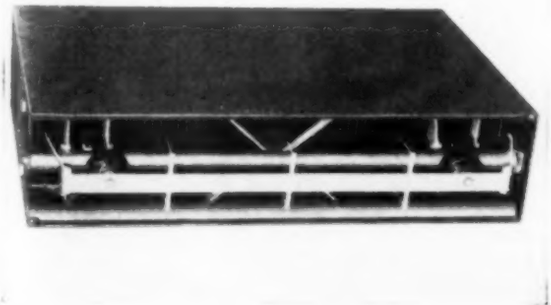
Lift Truck

Barrett-Cravens Co., 3250 West Thirtieth street, Chicago, has added to its line of lift trucks, as shown in the accompanying illustration. The new unit is a general purpose truck designed for handling office and supply room materials and a wide list of light weight items in industrial plants and warehouses. It is a combination lift truck with a full 2-inch lift for big loads handled on skids and a floor truck for bulky single objects, barrels, cases, bales, tote boxes, small bins, etc. The truck is equipped with four ball bearing wheels, front wheels swiveled. U-type tubular steel handle lifts loaded skid when pulled down to an angle slightly more than 45 degrees. Platform is

lowered by easy pull on trigger chain and can be handled with a finger. Truck is of steel construction with ample reinforcements in handle, chassis and platform to eliminate distortion or sagging.

Car Vibrator

Syntron Co., Homer City, Pa., recently has introduced a new, large type vibrator, shown in the accompanying illustration, which is fitted with hooks for attaching to hopper bottom railroad cars to speed the emptying process. The vibrator is a pulsating electromagnet striking 3600 blows per minute and with the hook weighs 950 pounds. The units are used in pairs, on opposite end sides of the car. Provision must be made for handling an overhead crane or hoist so that the vibrators may be adjusted rapidly, hooked and unhooked to and from one car to another. The vibrators without hooks also can be attached to big bunkers and storage bins to promote free flowing discharge of material. Each vibrator is equipped with a separate electrical control panel. The equipment is designed for operation on 220 volt, single phase, alternating current.



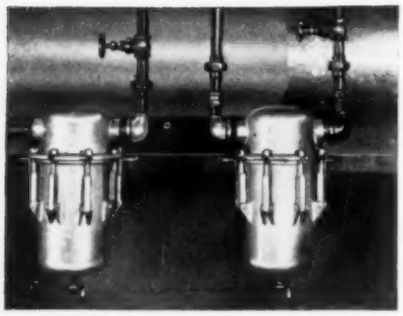
Radial Saw

Walker-Turner Co., Plainfield, N. J., announces a new radial wood working machine that rips and cross cuts, cuts miters and compound miters. With the spindle in vertical position it becomes a shaper. It routs and tenons. With the dado head it does notching, grooving and plowing. A geared head motor provides a 2-inch depth of cut with 1 horsepower, 3 inch with 2 horsepower and 4-inch with a 3 horsepower motor. A voltmeter indicates at all times whether the line voltage is sufficient for proper operation of the unit.

Another protective factor is a magnetic circuit breaker switch which permits the motor to work at full load capacity, yet cuts off the power on a sustained over load. Switch can be reset immediately without waiting for elements to cool. A compensating gear eliminates possibility of stripping teeth and requires no resetting. The sliding ram runs on dust sealed ball bearings mounted on eccentric pins to take up wear. Working table is laminated maple. All controls for raising lowering, and swinging the motor assembly and ram are positive in action and conveniently located.

Air Filter

Staynew Filter Corp., Rochester, N. Y., has introduced a new model air filter designed primarily for the removal of oil from compressed air lines, and for preventing the passage of dust, dirt, scale or any other foreign material. Main feature is a series of disks possessing



a large absorption area plus unusual filtering efficiency. The disks are carried on a tube, an inner liner of perforated metal covered with a fine bronze wire screen. Lower portion of the filter shell easily may be removed for inspection or cleaning. A deflector cup precipitates most oil or other foreign material to the sides of the shell by centrifugal force. Pipe sizes and filter capacities vary from ¼-inch pipe size for filter of 5 cubic feet per minute, to 2-inch pipe size for filter of 100 cubic feet per minute capacity.

Gage Fronts

Ashcroft American Gauge division, Manning, Maxwell & Moore Inc., Bridgeport, Conn., recently has made available on certain of its gages a new type front which is made of transparent plastic. The material is said to be nonbreakable with a tensile strength of 5000 pounds per square inch and a compression strength of 15,000 pounds per square inch. The transparent gape cover threads directlf on the gage making case moisture and

Lift Truck

Yale & Towne Mfg. Co., Philadelphia, has developed a new hand lift truck to handle heavy loads. The handle, designed for the safety of the operator, has a lower flush welded grip with no projecting edges. A positive mechanical selective or pump action lift, it is claimed, features effortless pump handle operation. The lift truck is available in capacities from 3500 to 5000 pounds in either wide or narrow frame models. Hydraulic release checks prevent dropped loads and torsion type rear links eliminate side sway. Designed for use with skid platforms, it is stated the new lift hand truck lends itself to carrying all kinds of heavy items.

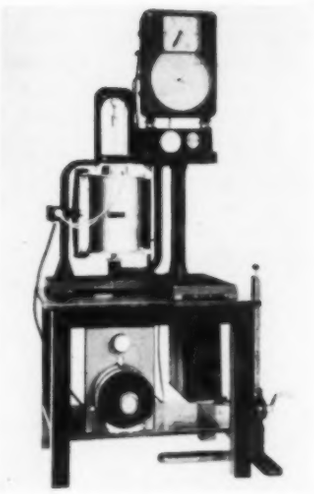
Electric Hoist

Shaw-Box Crane & Hoist division, Manning, Maxwell & Moore, Muskegon, Mich., has introduced two new hoists, one of 500 pounds and the other of 1000 pounds lifting capacity. These hoists for low head

room and heavy duty are of the wire rope and drum type. On both sizes the hook in highest position comes to within 12¼ inches of the bottom of the beam on which it travels. They are available in lug suspension for bolting in place, hook suspension for hanging in place and combined with a push type ball bearing trolley for operating on either I-beams or special monorail track sections. They are available with either pendent cord or push button control for operation on either single phase or polyphase alternating currents.

Dilatometer

A new dilatometer designed by Stanley P. Rockwell, Hartford, Conn., now is available through the Bristol Co., Waterbury, Conn. The instrument, which is shown in the accompanying illustration, has a direct reading dilatometer which both indicates and makes an ink record of time-dilation and temperature-dilation changes simultaneously, during heating and cooling cycles of ferrous and nonferrous metals, ceramics and many other materials



of rigid form. Temperatures are recorded on a potentiometer type pyrometer with a round chart, and the time element is recorded by a separate pen through a synchronous electrically operated clock.

Gouging Nozzles

Linde Air Products Co., unit of Union Carbide and Carbon Carp., 30 East 42nd street, New York, has developed a series of oxyacetylene gouging nozzles for use with a standard hand cutting blow pipe. The new nozzles are available in three sizes and provide a means for quickly and accurately removing a narrow strip of metal from surface of steel plate, forgings or castings. It is claimed the nozzles are designed to deliver a relatively large jet of oxygen at low velocity. By using various standard size nozzles the groove can be varied.

Electric Motor

Louis Allis Co., Milwaukee, has developed a new motor which is a combination of an eddy current clutch and a standard constant speed squirrel cage motor. There is no mechanical . contact between the driving and the driven members of the unit. Speed and torque variations are obtained by controlling the magnetic excitation of the clutch to obtain any desired slip. Gradual or

(*Continued on page* 94)

REMOVE SCALE

FROM BILLETS, CASTINGS AND FORGINGS

by AIRCO Flame-Descaling

THE PROCESS IS QUICK

A rapid pass of the high-temperature Airco oxyacetylene flame quickly heats loose and semi-tenacious scale without overheating the base metal. A differential expansion results — and the scale lifts immediately. It cracks and flies off in particles varying from 1/16 to 1/4 inch or more in width.

Flame-descaling billets with flat-tip assembly mounted on carriage.

THE PROCESS IS ECONOMICAL

It may be conducted by ordinary labor in areas adjacent to other plant operations or machinery. There are no handling or rehandling costs. Defects, seams and fissures that may later cause difficulty and perhaps failure are exposed. A natural surface, free from discoloration, is secured.

Flame-descaling a large casting with round tip mounted on extension.

THE PROCESS IS FLEXIBLE

Size or shape of object is no limitation. One hundred pounds to one hundred tons or larger objects may be flame-descaled. The apparatus employed is as flexible as a welding outfit—remote crevices and deep openings may be cleaned as well as flat surfaces.

Flame-descaling locomotive side and main rod forgings.

Write any Airco office for full details and copy of our new flame-descaling booklet.

AIR REDUCTION

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y. DISTRICT OFFICES IN PRINCIPAL CITIES

AIRCO *Anything and Everything for* GAS WELDING or CUTTING and ARC WELDING WILSON

(*Continued from page* 92)

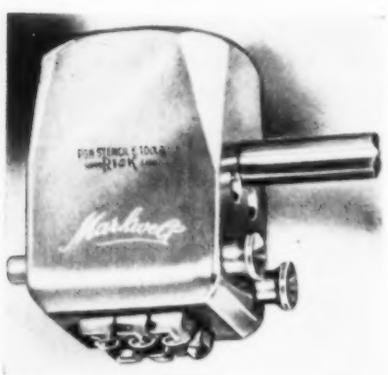
quick acceleration of load, rapid intermittent starting and disconnecting load absorbs torsional impulses and vibration. An unusually wide range of speed variations from zero to full speed are possible at full load torque. The unit can be operated continually at low speeds without over heating and causing trouble.

Pillow Block

Dodge Mfg. Co., Mishawaka, Ind., has introduced a double interlock pillow block designed for mounting on ordinary commercial shafting where the load is less than one requiring the clamp sleeve type bearing. Collars with two setscrews spaced 120 degrees apart on the outside of each end of the extended race ring secure the bearing to the shaft. In the nonexpansion type the inner unit is mounted in a two-piece cast iron housing. In the expansion type the inner unit is mounted in a two-piece cast outer housing with the inside machined with a straight cylindrical bore to fit the outside of the inner unit. Cap and base are machined to an accurate fit. Load capacity and top speeds may be increased if the bearings are mounted on shafts ground to full size. Labyrinth seals retain lubricant and protect bearing against entrance of foreign material.

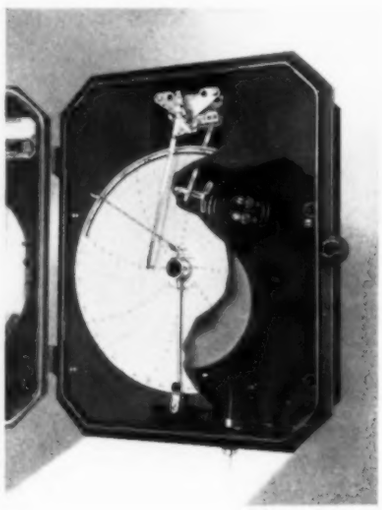
Tool Holder

Pittsburgh Stencil & Tool Co., 712 Crafts building, Pittsburgh, announces a new tandem tool holder claimed to be particularly suitable for stamping hot metal. It is pointed out that this double line axe ype holder, with three pieces of type in each line is much more likely, when swung like an axe, to imprint all six numbers than a holder with six numbers in one line. The only moving part is a sturdy pin which carries its own spring in each line of type. It is locked with one quick motion and unlocked with another. Holders are available in all sizes for type ranging from 1/16 to 1-inch or larger to meet various applications.



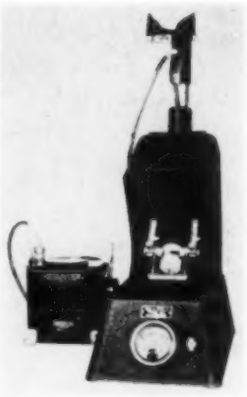
Recorders

Taylor Instrument Companies, Rochester, N. Y., have developed new recorders for temperature, humidity, pressure, load, rate of flow, liquid level and receivers for pneumatic transmission systems. Cases are drilled and tapped to receive any of the five standard control mechanisms if required later. The case is sealed against dust and moisture by door gaskets and positive bayonet action latch. Time previously required for changing charts is cut in half by a uniquely designed mechanism that combines the chart locking device and pen lifter. The chart may be removed and replaced easily with one hand. A die cast aluminum chart plate gives a rigid surface for pencil notations on chart and for carrying the chart clamp and pen lifter. The recorders are available with 10 or 12-inch charts and with one, two or three pens.



Sinter Meter

Harry W. Dietert Co., 9330 Roselawn avenue, Detroit, recently has placed on the market an improved model of a sinter meter, shown in the accompanying illustration, for determining the refractoriness of molding sands, core sands, clays, mortars, bricks and other materials of a somewhat similar character. Refractoriness is determined by placing the sample under a platinum-rhodium ribbon. The ribbon is heated to increasing elevated temperatures until the sample is fused and a small portion burns on the ribbon. Temperatures are measured with an optical pyrometer. The temperature at which the first fusion takes place is determined by raising ribbon off the sample. The ribbon is heated with an electric current controlled with a transformer and varitran. Incipient fusion temperature is termed sintering temperature and the test is made in accordance with A.F.A. specifications.

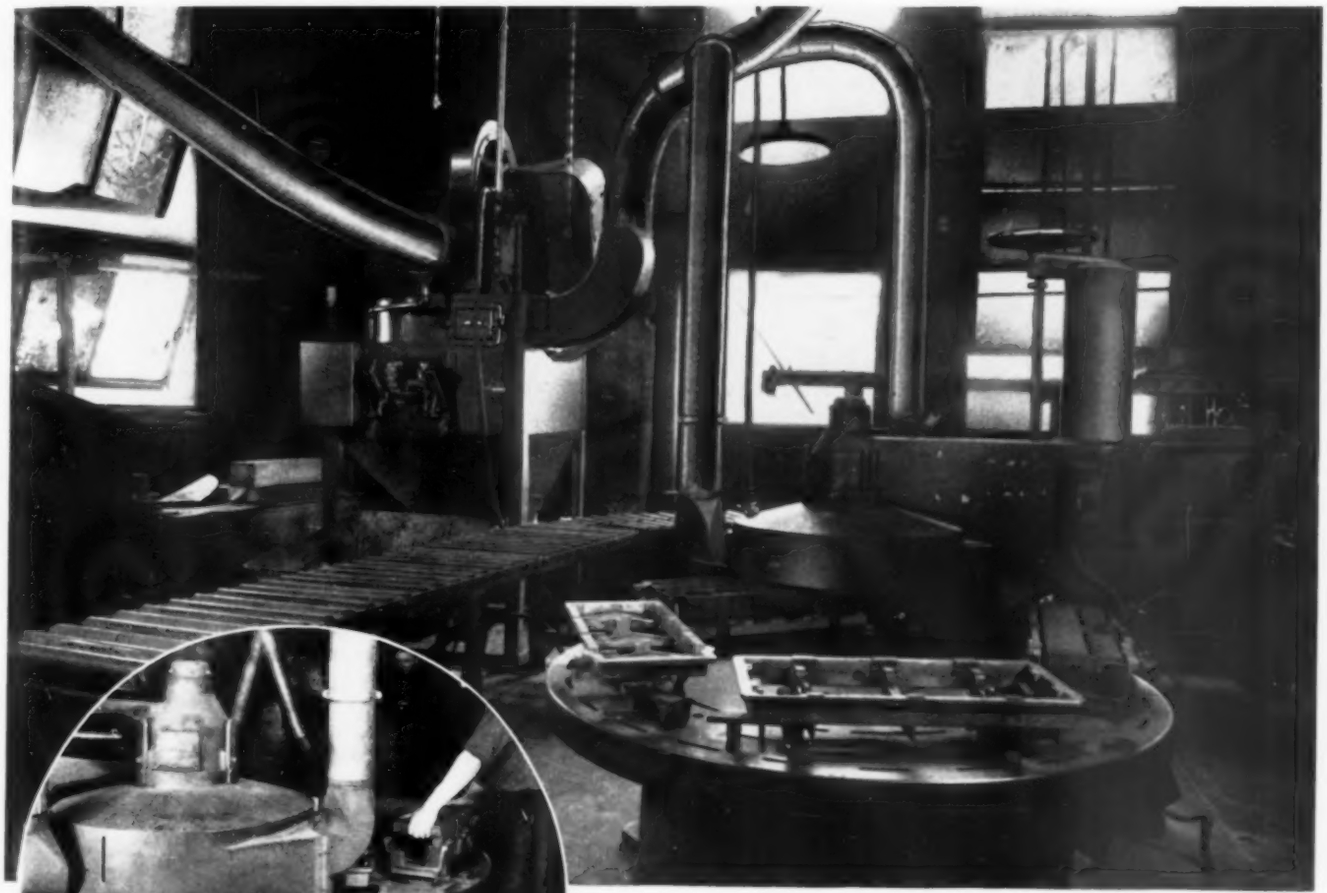


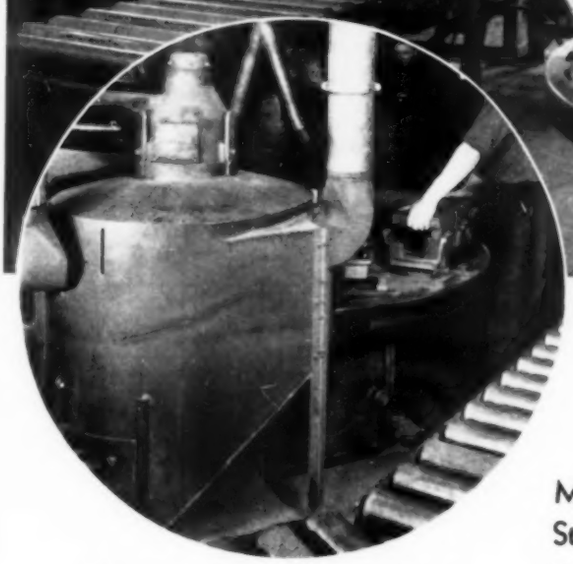
Oil Burner

Hauck Mfg. Co., 124 Tenth street, Brooklyn, N. Y. has introduced a proportioning low pressure oil burner which does not require extra valves and is ready to hook up to temperature control equipment for accurate combustion and temperature control. Burning any grade of oil the moving of a single lever automatically controls the air and oil supply and simultaneously adjusts primary and secondary air orifices in the burner. Once set, any desired oil-air ratio automatically is maintained thereafter.

The manufacturer claims this new burner automatically proportions primary and secondary atomizing air and oil flowing through the burner from minimum to maximum capacity and maintains the desired furnace atmosphere. Among other prominent features it is stated the burner produces the greatest turn down ratio because it maintains full primary and secondary air pressure and velocity at the atomization point; combines a straight line flow oil valve with a straight line flow air control mechanism in a single unit; requires only one air connection and has no external oil tubing; simple to operate with indicator dials on all adjustments for duplicate burner settings; straight line flow characteristics and is used with other straight line flow valves to produce combustion with heated air from regenerators or recuperators.

CORE GRINDERS NEED *Dust Collection,* TOO!





Close up of the unique hood construction and exhaust ducts of the Milwaukee No. 70 Core Grinder served by a No. 10 Type W Roto-Clone.

● The Roto-Clone is particularly well adapted to the collection of objectionable dust generated by Core Grinding and Drilling operations. Above is a typical Roto-Clone installation exhausting 2500 c. f. m. from a Milwaukee No. 70 Core Grinder and a Core Drilling Station.

Because the Roto-Clone is a compact, self contained unit, it is easily installed and may be located in space not suitable for other uses. Where floor space is not available it may be placed over head.

Do you have the new Roto-Clone picture book showing 80 typical installations? Your free copy is waiting. Please write.

TYPE W ROTO-CLONE

AMERICAN AIR FILTER CO., INC.
INCORPORATED
715 Central Avenue **Louisville, Ky.**

FOR FOUNDRY AAF DUST CONTROL

Foundry Activities

SAGINAW Malleable Iron division, General Motors Corp., Saginaw, Mich. is planning construction of a large addition to its plant, the second expansion this year, as announced by William H. Doerfner, plant manager. The new structure will house an annealing furnace, which, with the earlier addition, will be used for the manufacture of the entire 1941 production of camshafts for Chevrolet trucks.

* * *

Arneson Foundry Co., Kenosha, Wis., has let contract to J. C. Tully Co., for a foundry addition.

* * *

Cockshutt Plow Co., Brantford, Ont., has started construction of an addition 70 x 200 feet.

* * *

Sorel Steel Foundries Ltd., Sorel, Que., is constructing an $80,000 plant addition.

* * *

Guelph Stove Co., 490 York road, Guelph, Ont., is building a plant addition 50 x 130 feet.

* * *

American Brake Shoe & Foundry Co., Ramapo Valley road, Mahwah, N. J., is building a one-story, 50 x 108-foot addition.

* * *

Wilson Foundry & Machine Co., Pontiac, Mich., is erecting a new office building and is adding to and altering its plant.

* * *

Gurney Foundry Co., Ltd., 100 Principale street, Ville St. Laurent, Que., Canada, is building a plant addition costing about $65,000.

* * *

Messmer Brass Co., 2700 South Seventh street, St. Louis, recently bought adjoining property and plans a plant addition containing 24,000 square feet of floor space.

* * *

Menasco Mfg. Co., Los Angeles, Calif. is building a new aircraft engine factory at Burbank, Calif., and the present plant, 6917 McKinley avenue, Los Angeles, will be used entirely as a foundry.

* * *

Hoosier Stove Co., Marion, Ind., has filed papers for dissolution. Equipment has been sold, and the patterns and special equipment of the foundry have been purchased by the Pope Foundry, 33rd and Adams street, Marion. The latter company will continue to supply repair parts for users of stoves previously made by the Hoosier Stove Co.

* *

Foundry Service Inc., Anderson, Ind., has been incorporated with 1000 shares of stock to manufacture castings, by Arthur A. Brady and associates.

* * *

Utility Electric Steel Foundry, 3384 South Slauson avenue, Los Angeles, is constructing a new factory building 55 x 60 feet that will cost $5500.

* * *

Western Stove Co., Culver City, Calif., has started a $25,000 expansion to include an addition to the plant and the purchase of additional property for future expansion. Earl C. Planett is general manager.

* * *

Haynes Stellite Co., unit of Carbide & Carbon Corp., Kokomo, Ind., is expanding its manufacturing facilities by the addition of a new 75 x 132-foot factory for the manufacture of stellite alloy products including special castings for resisting abrasion, corrosion and heat.

* * *

Los Angeles-Glendale Foundry Co., is the firm name under which Wilhelmina F. Bleuel has obtained a certificate to conduct business at 4913 San Fernando road, Glendale, Calif.

* * *

Motor Castings Co., Milwaukee, has opened another plant which is located at 7225 West Main avenue with employment for 75 to 80 men, as announced recently by E. L. Roth, president. New division will specialize in machine tool orders and heavier castings.

* * *

Shipyards, Inc., has been organized by the Harriman interests in Philadelphia, as the initial step in reopening the former Cramp shipyards. It is reported that the yard is being reopened to recondition a large number of destroyers idle since world war days.

* * *

Total sales of foundry equipment during June, according to the recent report of the Foundry Equipment Manufacturers association, Cleveland, was 164.9 per cent, as compared with 129.1 per cent in May. This is based on the average for 1937-38-39 as 100 per cent.

* * *

Liberty Foundry, Inc., Wauwatosa, Wis., the Spring City Foundry Co., Waukesha, Wis., and the Milwaukee Steel Foundry Co., Milwaukee, recently have increased the terms of the individual companies' group life insurance program to provide employes with funds to help meet costs of temporary disability and surgical operations, together with benefits payable to the workers and to their dependents in case of their respective hospitalization.

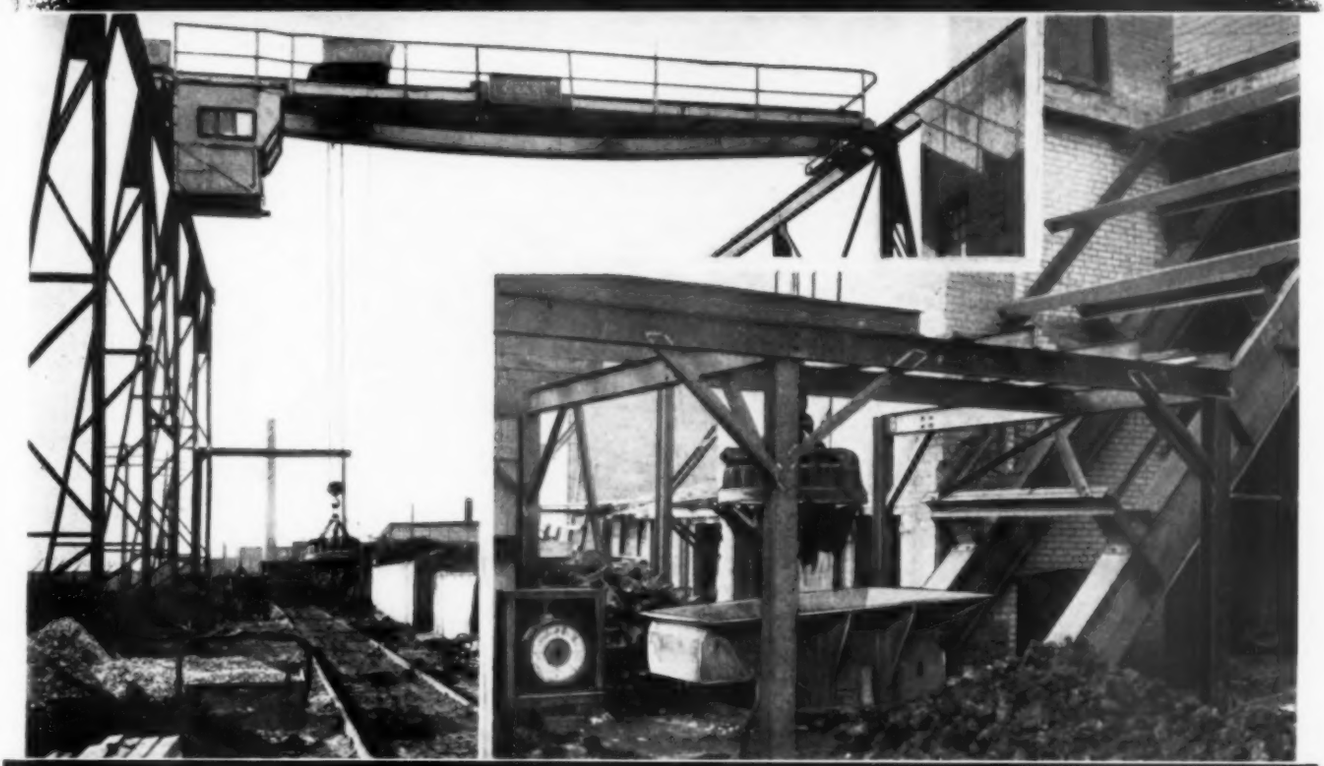
RAW MATERIAL PRICES
Aug. 14, 1940

Iron	
No. 2 foundry, Valley	$23.00
No. 2 Southern Birmingham	19.00
No. 2 foundry, Chicago	23.00
No. 2 foundry, Buffalo	23.00
Basic, Buffalo	22.00
Basic, Valley	22.50
Malleable, Chicago	23.00
Malleable, Buffalo	23.50
Charcoal iron, furnace	27.00
Coke	
Connellsville beehive premium	$5.75 to $6.30
Wise county beehive coke	5.50 to 6.50
Detroit by-product delivered	11.00
Scrap	
Heavy melting steel, Valley, No. 2	$18.00 to $18.50
Heavy melting steel, Pittsburgh, No. 2	18.50 to 19.00
Heavy melting steel, Chicago, Auto No. 2	15.50 to 16.00
Stove plate, Buffalo	15.00 to 15.50
Stove plate, Chicago	11.50 to 12.00
No. 1 cast, mchy., New York	17.00 to 17.50
No. 1 cast, mchy., Chicago	17.00 to 17.50
No. 1 cast, Pittsburgh	19.00 to 19.50
No. 1 cast, Philadelphia	21.50 to 22.00
No. 1 cast, Birmingham	15.50
Car wheels, iron, Pittsburgh	20.50 to 21.00
Car wheels, iron, Chicago	18.50 to 19.00
Railroad malleable, Chicago	21.50 to 22.00
Malleable, Buffalo	21.50 to 22.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	10.50
Straits tin	50.75
Aluminum, 99 per cent	18.00
Aluminum, No. 12 (Secondary, standard)	14.00
Lead, New York	4.75
Antimony, New York	14.00
Nickel, electro	35.00
Zinc, East St. Louis, Ill	6.50

Layout Dope

Tamms Silica Co., 228 North LaSalle street, Chicago, recently has developed a new layout dope suitable for tool and die makers use. The material comes in liquid form ready for use. It is blue in color, and claimed to dry quickly, and will not rub off. A scribe or layout tool shows a clear, distinct line without chipping or scraping.

HARD WORK ELIMINATED
OPERATING COSTS REDUCED



with MODERN *Richardson Cupola Chargers*

Modern Charger with Magnet Crane at Marshall Furnace Co., Marshall, Mich.

Consider the following big advantages of the Modern Charger

1. Charges evenly distributed and well packed in the cupola, stratification of charges maintained.
2. Expensive rehandling eliminated:—
   Loading with magnet crane and Modern weigh hoppers as above most efficient system obtainable anywhere.
3. Adapted for all sizes and types of cupolas—a type for every condition.

Tremendous savings can be made and many melting worries overcome with MODERN charging systems. Let Modern Engineers check over your conditions and recommend a system that will best take care of your problems.

MODERN

Cupolas
Covered & Insulated Ladles
Improved Bottom Pour Ladles
Lifetime Geared Ladles
Metal Pouring Systems
Crane & Monorail Systems Metal & Mold Handling
Furnace Charging Cranes

Mfgd. under U.S.A. patents 2200652 and 2200653. Others pending.

MODERN EQUIPMENT COMPANY

PORT WASHINGTON, WIS., DEPT. 171

MODERN EQUIPMENT CO.

DISTRIBUTING OVERHEAD COSTS

(*Continued from page* 34)

would produce 6340 pounds of castings per day. This divided into $2.97, the daily equipment cost for the ten machines, gives a cost of 5 cents per hundred pounds.

No matter which basis (hours, pay or weight) is used, there is enough difference in results to warrant serious consideration.

Uniform wage rates and uniform daily production are used in Table III so as to confine the rate variations to different sizes of machines.

There are some molding expenses that have a general relationship with time; with wages where there is uniformity among the several sizes of equipment; or with weight produced where there is uniformity among the several sizes of equipment. However, uniformity of wages and weight produced are likely to vary as between the several sizes of machines. Therefore, it is not safe to use these factors as a basis for overhead distribution to units produced, as will be shown later.

Table IV illustrates the distribution of this class of expenses and the costing rates for each production center, based upon normal hours; uniform daily wages for each center; and like weights produced per molder for each center. It is understood that some of the kinds of expense shown in Table IV can be analyzed further if a more refined distribution is needed for the individual foundry. However, this illustration seems sufficiently segregated to test the practicability of using production center rates.

In many foundries, making both light and heavy castings, some flasks and castings must be handled by an overhead traveling crane. Cost of this service is difficult to apply to individual jobs. To include the cost of crane service in the general overhead seems illogical when only part of the jobs use the crane. Such a distribution would increase falsely the cost on light jobs, whether they be molded in or out of the floors served by the crane. Conversely, the cost of many heavy jobs would be understated because some of the cost of crane service used by these jobs would be charged to the light castings.

Table II shows the daily cost of operating the crane and the distributing factors for four different methods. Before deciding on which method to use, test costs should be made by applying each method to a representative number of jobs covering various shapes and weights.

Daily costs for building, equipment, general expense and crane service for each production center and the entire molding department are consolidated in table V and the distributing rates established for each.

Overhead Rate Per Hour as shown in Fig. V is determined by dividing the Total Cost, shown in line 5 by the Normal Hours, indicated on line 7.

Overhead Per Cent of Normal Pay is determined by dividing the Total Cost by Normal Pay as shown on line 3.

Cost Per Hundred Pounds is determined by dividing the Total Cost, by Average Production Per Man.

Observe that the distributing rates are quite different for the different production centers.

Having established distributing rates where uniform conditions prevail, let us test the usability of the method of overhead distribution by production centers within the department, as compared with using a blanket departmental rate. These tests can best be made by examples of costs of several jobs figured by using the departmental rate and the same jobs figured by production center and rates, and comparing.

We will first test the accuracy of distributing overhead by per cent of normal pay and cost per hundred pounds in comparison with hourly rates shown in Table VI. Division *A* shows that using any one of the three bases of overhead distribution will produce like costs where the wage and production are in ratio with the figures used in establishing normal overhead. (Table V).

(*Concluded on page* 100)

Table VI

Hand Ramming

	Hourly Rates	Per Cent of Labor	Cost per cwt.
A—Direct Labor 6 hours @ 80c	$4.80	$4.80	$4.80
Overhead—6 hours @ $1.02	6.12	.....	.....
—$4.80 Labor @ 128 per cent	.....	6.14	.....
—634 pounds @ 97c per hundred pounds	.....	.....	6.15
Total	$10.92	$10.94	$10.95
B—Direct Labor 6 hours @ 60c	$3.60	$3.60	$3.60
Overhead 6 hours @ $1.02	6.12	.....	.....
—$3.60 Labor @ 128 per cent	.....	4.90	.....
—634 pounds @ 97c per hundred pounds	.....	.....	6.15
Total	$9.72	$8.50	$9.75
C—Direct Labor 6 hours @ 80c	$4.80	$4.80	$4.80
Overhead—6 hours @ $1.02	6.12	.....	.....
—$4.80 Labor @ 128 per cent	.....	6.14	.....
—350 pounds @ 97c per hundred pounds	.....	.....	3.40
Total	$10.92	$10.94	$8.20

Table VII

Hand Rammed Job

(1000 Pounds)

	Department Average	Production Center
Direct Labor—6 hours @ 70c	$4.20	$4.20
Overhead—Building Expense 900 feet @ .0009	.81	.81
—Equipment Expense	.86	.07
—General Expense	4.84	4.84
—Crane Expense	.41	not used
Total	$11.12	$9.92
Cost per hundred pounds	$1.11	$ .99
Variance	10%	100%

Table VIII

Job on $5000 Machine

(1000 Pounds)

Direct Labor—6 hours @ 90c	$5.40	$5.40
Overhead—Building Expense 900 feet @ .0009	.81	.81
—Equipment Expense	.86	3.08
—General Expense	4.84	4.84
—Crane Expense (30 lifts)	.41	3.00
Total	$12.32	$17.13
Cost per hundred pounds	$1.23	$1.71
Variance		39%

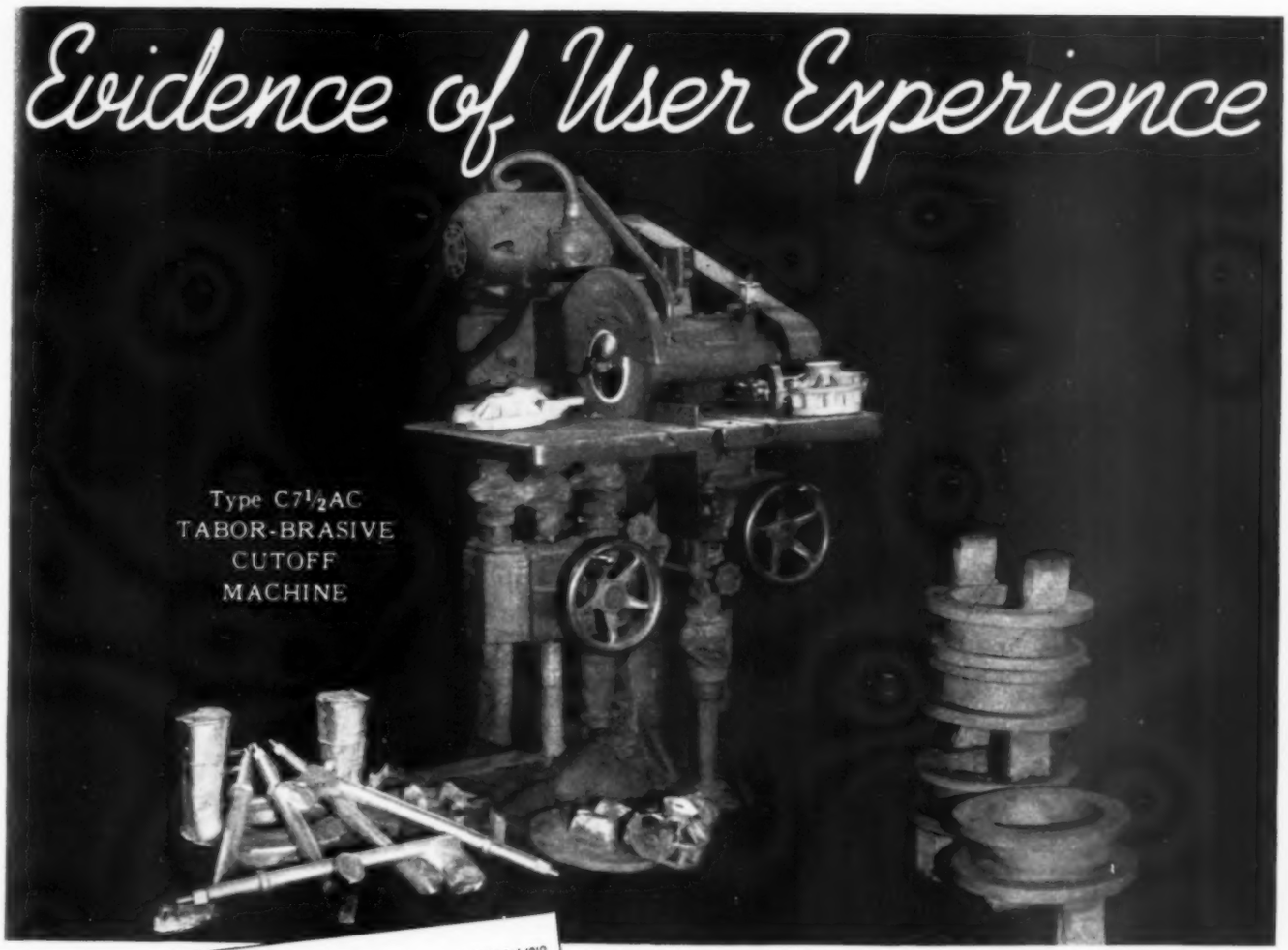
Table IX

Job on $1000 Machine

(1000 Pounds)

Direct Labor—6 hours @ 80c	$4.80	$4.80
Overhead—Building Expense	.81	.81
—Equipment Expense	.60	.62
—General Expense	4.84	4.84
—Crane Expense	.41	not used
Total	$11.46	$11.07
Cost per hundred pounds	1.15	1.01
Variance—approximately none		

Evidence of User Experience



Established 1910

Telephone SOMERSET 2710

Somerville Machine & Foundry Co.

BRASS, BRONZE, ALUMINUM and MONEL CASTINGS
MACHINING and METAL PATTERNS
BRONZE SIGNS and TABLETS

14 KENT STREET, SOMERVILLE, MASS.

June 18, 1940

The Tabor Manufacturing Company
6225 Tacony Street
Philadelphia, Pa.

Gentlemen:

On December 14, 1939, you shipped us one Tabor-Brasive Cutoff Machine, Type C 7-1/2 AC, numbered 21719. Upon its arrival, it was promptly installed.

The performance of this machine has been so remarkable and so satisfactory that we feel obliged to express our appreciation. From records carefully recorded, the savings in our cutting costs for the four month period were equivalent to the cost of the machine. In other words, in four months time the machine has paid for itself. We wonder how any busy foundry could get along without it.

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By F.G.Volpe, Treas.

By: F.G.Volpe, Treas.

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(*Concluded from page 98*)

Division *B* shows the effect on the total molding cost where the wage differs with the normal and the production is normal. Higher than normal wages would give a higher cost.

Division *C* shows the effect on the total molding cost where the production is lower than normal. There is always variance of weight produced per day on different castings. Therefore, the fallacy of using weight produced as a basis for overhead distribution is clearly indicated.

Having shown the unreliability of distributing molding overhead on either the basis of wage or weight, the following examples will be based on the reliable basis of normal hours. Purpose of these examples is to determine the advantage, if any, of using production center rates over using the same rate for all jobs.

Costs Will Vary

Table VII depicts a 6-hour hand rammed job. Variance in costs by distributing overhead on a departmental or production center basis is caused; first by the difference in hourly cost of equipment expense and second by charging crane cost to a job not using service.

Table VIII depicts a 6-hour job on the $5000 machine. Variance in costs (calculated by departmental averages and specific machine hourly rates) is caused; first by the difference in hourly costs on this machine and the average for the departmen, and second by charging crane cost on the basis of actual service rendered, rather than through a blanket departmental overhead rate.

Table IX depicts a day's run on a $1000 machine. There is approximately no variation in cost by using departmental or production center rates or blanket departmental rates because cost of operating this machine agrees closely with the departmental averages.

By use of the preceding tables, it is obvious that there is merit in the use of production center rates rather than using rates that average all sizes of molding machines.

In assigning a job for molding it is important to know the type and size of equipment that will produce the mold both accurately and economically. Not only is the number of molds in a specified time essential, but the cost of operating the production center is helpful Quite often jobs are assigned to specific production centers because a few more molds can be made on a specific machine than by other machines. It is possible that the added expense to operate the machine will more than offset the extra quantity production. Knowledge of production center rates is the only method known to the author that will definitely measure this difference.

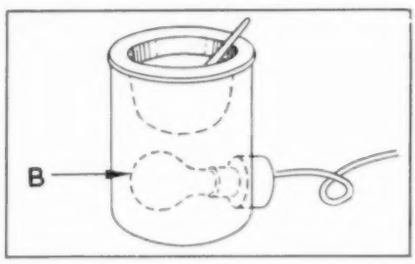
In installing new molding equipment it is helpful to predetermine productivity; accuracy; economy. Economy can only be determined by dividing the productivity into the cost of operating the equipment. Therein lies the advantage of analysis of operating conditions that will affect only this particular piece of equipment and applying the cost accordingly.

Since the author fully realizes that this procedure of costing is a radical departure from the usual custom, criticism is invited.

Light Bulb Keeps Glue Pot Hot

By A. H. Waychoff

Patternmakers or other workmen who require hot glue will find the simplified electric glue pot, shown in the accompanying illustration, a time and money saver as well as a great convenience. A hole is cut in the bottom of a 1/2-gallon syrup pail large enough to hold the glue pot. A wall lamp socket is mounted on the inside of the pail as shown at *B*. A cord long enough to reach the nearest lamp socket and a 5-watt bulb complete the assembly. Cost of current will amount to about 10 cents for 200 hours. This is cheaper than stopping to light a gas burner to heat water each time a little glue is wanted. Heat from the small bulb will not burn the glue but will keep it hot enough for good work for several hours.



Small bulb develops enough heat to keep glue ready for use

"Lighting and Air Conditioning for the Modern Plant" is the subject of a booklet recently issued by the American Management association, 330 West Forty-second street, New York. Articles included are written by W. C. Brown, General Electric Co., A. E. Stacey Jr., Buensod-Stacey Air Conditioning, Inc., and William B. Henderson, Air Conditioning Manufacturers' association. The booklet may be purchased from the association for 75 cents.

Organize Gray Iron Research Group

Organization of the Gray Iron Research institute to conduct a program of scientific foundry research and technical development at Battelle Memorial institute, Columbus, O., recently was announced. Charter members include the following foundries: Advance Foundry Co., Dayton, O.; Buffalo Foundry & Machine Co., Buffalo; Bullard Co., Bridgeport, Conn.; Carondelet Foundry Co., St. Louis; Chicago Hardware Foundry Co., North Chicago, Ill.; Forest City Foundries Co., Cleveland; Fremont Foundry Co., Fremont, O.; Spring City Foundry, Waukesha, Wis.; United States Pipe & Foundry Co., Burlington, N. J.; and Worthington Pump & Machinery Co., Harrison, N. J.

As a first part of the program it is planned to conduct studies of the fundamental principles of the cupola melting of gray cast iron, using the combined laboratory facilities of the fuels and metallurgical laboratories as well as the experimental foundry at Battelle. It is expected that these investigations will provide the groundwork for more accurate control of metal quality and composition and that the technical information obtained in the operation of the experimental cupola will indicate to the member foundries the change in practice and control necessary to obtain the highest quality metals.

The experimental program at Battelle will be under the direction of Dr. C. H. Lorig, supervising metallurgist, and R. A. Sherman, head of the fuels division. John Lowe, foundry engineer on the Battelle staff, will serve as contact man between the laboratories and the member foundries, so that the results obtained in the research program can be translated into practical foundry operations without loss of time.

A. H. Kramer, president, Advance Foundry Co., is president of the Gray Iron Research institute; Charles F. Seelbach, vice president, Forest City Foundries Co., is vice president; J. D. Coltman, foundry superintendent, Bullard Co., is treasurer and C. R. Culling, vice president, Carondelet Foundry Co., is secretary. In addition to these men the trustees are as follow: H. D. Miles, president, Buffalo Foundry & Machine Co., E. B. Sherwin, president, Chicago Hardware Foundry Co., Charles J. Miller, president, Fremont Foundry Co., H. P. Kreulen, vice president and treasurer, Spring City Foundry Co., Dr. A. E. Schuh, U. S. Pipe & Foundry Co., and R. J. Allen, Worthington Pump & Machinery Corp.

GLASS MOLDS PRESENT PROBLEMS

(*Continued from page* 36)

grain. Chromium has a marked influence in preventing excessive softening at elevated temperatures. Burgess points out that an unalloyed iron after treatment at 750 degrees Fahr. dropped to a brinell hardness of 110 while at 0.52 per cent chromium iron retained a hardness of 180, a drop of 12 brinell numbers. In the same series of tests it was shown that chromium effectively prevents growth. Any carbide stabilizing alloy helps in the resistance of iron to growth and heat.

Chromium is one of the most potent alloys that may be used either alone or in combination with other alloying elements. In percentages varying from less than half of one per cent to 1.50, it will prove of considerable benefit in the enhancing of desired physical characterics and prevention of corrosion, growth and breakdown at high temperatures. As the percentages are increased it may prove either beneficial or seriously will effect machinability and other properties. Use of chromium in austenitic irons will be discussed briefly later.

Hardens the Matrix

Nickel restrains chill, mildly decreases stability of carbides, mildly refines graphite structure, has a mold effect on combined carbon and refines and hardens a pearlitic matrix. Use of nickel as a substitute for silicon is well known to foundrymen. Normally the addition of nickel is preferred to an increase in the silicon percentage. Excessive silicon additions promote a coarse graphitic structure, a less dense iron and a tendency to increased porosity.

As an alloying member in glass mold irons, nickel is particularly beneficial in promoting machinability. It promotes density and freedom from porosity by making a lower silicon percentage permissible. Nickel when used to displace silicon contributes markedly to growth resistance according to J. S. Vanick, "Metallurgical Analysis of Glass Mold Irons," *The Glass Industry*, July-August, 1938. Expansion with up to about 5 per cent nickel is slightly lower than for plain cast iron according to *Metals Handbook*, 1939, page 627. In this connection nickel should prove of value as silicon increases expansion. Most of the alloys contribute toward graphitic refinement in some degree and nickel is no exception.

Nickel should be a valued addition to the possibilities suggested for alloying glass mold irons. Generally it is advisable to use nickel with other alloying elements which have a tendency to increase the combined carbon. It may be used with chromium or molybdenum or with both. Vanadium also may be used. Individual effects of the alloys, when used in the proper proportions are preserved and are effective in the structure of the alloyed iron.

As stated in *Alloy Cast Iron*, page 14, copper has found some favor in mold irons particularly in combination with chromium. Graphitizing ability is about one-tenth to one-fifth that of silicon. It tends to increase density, refines the pearlite, has little effect on chill, and little effect on carbide structure. Copper is finding increasing uses as an element to combat corrosion in iron and steel. Growth and scaling tendencies seem to be accelerated somewhat but may be mitigated by the use of chromium additions.

Molybdenum mildly increases chill, is about neutral in its effect on carbides, strongly refining as to matrix or structure, mildly increases the combined carbon, and refines the graphite. Addition of molybdenum increases structural uniformity con-

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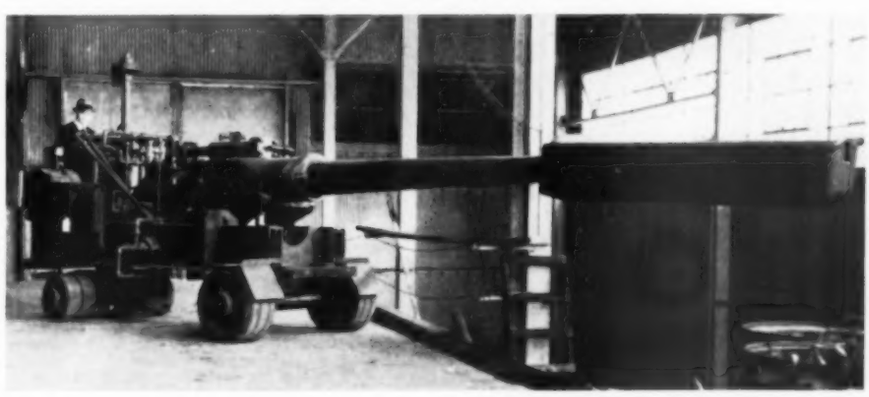
Bottom View—*A 6900# Capacity Box Charger.*



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ducive to good density, low thermal expansion, and high conductivity.

Molybdenum has a marked effect analogous to its effect on steel, in maintaining strength of cast irons and structural characterics at elevated temperatures. In combination with other alloys, such as nickel, chromium or copper, it seems to enhance their respective abilities in resistance to elevated temperatures. It has a tendency to decrease growth particularly if used in percentages between 0.75 and 1.00 per cent. Molybdenum has been used effectively in glass mold irons up to 1.00 per cent, alone, and in combination with approximately 0.30 per cent chromium. Other combinations using additional alloys may be used also.

Use of vanadium in iron is somewhat analogous to use in steel. It is a powerful carbide forming element, stabilizing cementite and restraining graphitization. It is of benefit in articles having heavy and light sections. As little as 0.10 per cent vanadium decreases distortion and reduces increase in linear dimensions at elevated temperatures. The same addition increases the hardness and depth of the chill. Vanadium in small percentages may be added alone or in combination with other alloys to make a suitable glass mold iron.

One of the popular combinations of alloying elements is that of nickel and chromium. These alloys usually are added in the proportions in which they neutralize each other in respect to chill. The resultant iron has the same chilling tendency as the base to which it is added, machinability also will be approximately the same with the beneficial effects of the chromium and nickel on structure and properties being conserved. Particularly in the foundry producing a small amount of special irons, this combination is helpful as it does not require a change in cupola mix. In special applications the austenitic irons are useful. Increasing amounts of nickel and chromium result in greater resistance to corrosion, growth and scaling.

Silicon generally is not considered as an alloying element in cast iron. As in steel, high percentages have proven of value in heat resistant applications. There seems to be a rather definite comparison between the percentages of silicon used in steel and those used in a heat resisting iron containing 6 to 8 per cent silicon. This latter iron has shown unusually good properties. Insofar as silicon is concerned there are rather extensive possibilities open for experimentation.

Deoxidizers Are Used

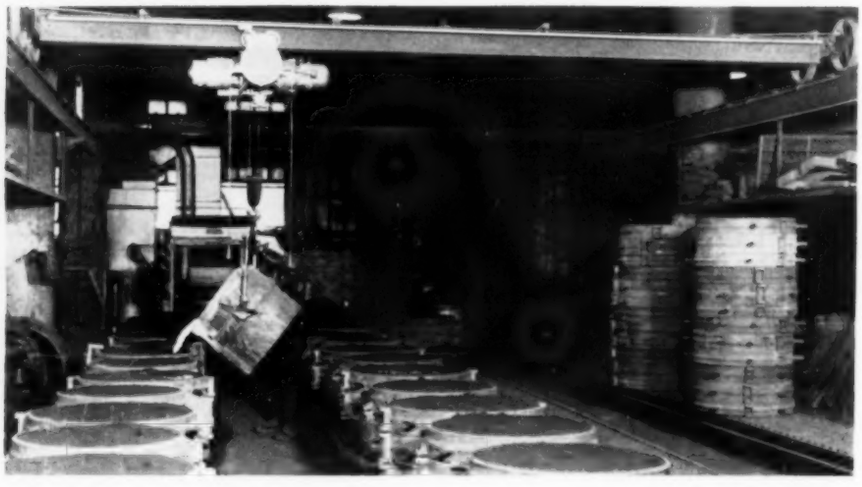
Other elements which may be cited as having peculiar or rather individual properties are the deoxidizers. Titanium is particularly valuable if used correctly. It improves the physical properties probably as a result of the deoxidizing process removing impurities from the iron. It has a restraining influence on the chill and refines the graphitic structure. Titanium is a more powerful graphitizer than silicon. Like any other alloying agent, titanium must be used correctly.

Numerous commercial compositions on the market may be used with beneficial results. They serve primarily as deoxidizing agents and their effect on the physical nature of the iron is indirect.

To a man with a background of years of experience in steel mills producing high grade tool steels it seems almost incomprehensible at times the casual way in which cast irons are made in some foundries. A good base iron is closely related to a carbon tool steel in structure and matrix. In a steel mill a carbon tool steel is recognized as one of the most difficult steels to produce to strict specifications and desired uniformity from heat to heat. Every step, every phase of its manufacture is under the strict guiding hand of metallurgist and skilled

Gray Iron foundry converts unused storage bay into **PRODUCTIVE** *space*

OVERHEAD CRANE INSTALLATION BY CHICAGO TRAMRAIL



Closeup view of four roller conveyors served by Chicago overhead crane in middle western foundry.

Typical of the manner in which unproductive space can be quickly converted into *usable* space with minimum investment is this recent installation which called for a moderate-priced, but dependable overhead crane. Study indicated the overhead push-type crane with variable speed hoist as shown. Our experience and facilities for solving material handling problems in the foundry are described in Bulletin PCR-100-D. May we send you a copy?

■ **Savings of $45 daily are reported by the foundry whose installation we described in this space in the August issue.**

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workman from raw materials to the finished heat treated article. The question sometimes comes up as to what the foundryman could do with cast iron if the same precise metallurgical control were used. A few years ago gray iron was gray iron and little could be done about it. The tide has turned and a few determined men have made iron a suitable engineering product.

Introduction of alloyed irons should cause no particular disturbance. Except in the highly alloyed austenitic irons ordinary pattern shrinkage is generally satisfactory. Warpage characteristics are similar to those of unalloyed irons. The same general considerations used in gating and feeding, risers, etc. of unalloyed iron apply since solidification remains comparatively constant for the small alloy percentages.

Molding sands may make or break any casting alloyed or unalloyed. Assuming that the foundry has an adequate sand control and testing system no sand difficulties should be encountered. Alloy irons probably will be poured at a somewhat higher temperature than the unalloyed.

Melting processes are important features in the production of alloy irons. Dependent upon the type of melting unit, scrap and charging materials are of paramount importance. The actual melting process should be controlled carefully. In the use of alloys the time and temperature of additions are in some cases highly important. Methods will vary according to the melting unit but it should be pointed out for all that exacting standards should be established and maintained.

The field of alloyed irons for glass molds covers such a wide variation of possible alloy combinations that it would be impossible to discuss specific analyses which might be used and do justice to all the alloy combinations which could prove of value. Service conditions vary to such a degree that individual studies of the different applications would prove beneficial to supplier and user. Equipment and personnel of the foundry play a vital part in the final selection of an analysis. An analysis may be duplicated but that does not necessarily imply that performance will be. Processing is of too much importance. In the final analysis, the mold maker's and founder's desire is to furnish an iron of maximum utility and that desire involves knowledge, study and control no matter what the analysis may be.

This is the second and concluding section of an article dealing with many of the complex problems involved in the production of cast iron molds for glass making. The first part appeared in the August issue of THE FOUNDRY.

Book Review

Annual Statistical Report of the American Iron and Steel Institute, fabricoid, 104 pages, 6 x 9 inches.

The twenty-eighth annual statistical report of the American Iron and Steel institute presents statistics of the iron and steel industry and some related industries of the United States and Canada for the year 1939. In most of the tables comparable data also are shown for at least 4 or 5 preceding years. Continuing the practice adopted some years ago, the figures of total steel production include with steel ingots only that part of steel for castings which was produced by companies also making ingots. All tonnage figures shown in the report are net tons, those of 2000 pounds, rather than gross tons of 2240 pounds.

Albert Kahn, Inc., New Center Building, Detroit, has been changed to Albert Kahn Associated Architects and Engineers, Inc. The new corporation includes a number of members of the organization who have been connected with the former firm for approximately 25 years. Albert Kahn and Louis Kahn will head the organization.

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CASTINGS MADE IN MODERN FOUNDRY

(*Concluded from page 42*)

pounds each, and the third or holding furnace with a capacity of 320 pounds. Hand ladles are used for pouring. The metal is melted fast and 3000 pounds of metal easily can be melted per day. The holding furnace is equipped with modern control apparatus including potentiometer and a motorized ratio valve. In these furnaces as well as those on the brass side across the foundry, crucibles are employed.

Heat, smoke and gas over the aluminum furnaces are removed by large ventilating hood and a 36-inch fan. Permanent mold castings are made opposite the holding furnace in a battery of five book type molds.

Aluminum castings are made in sand molds in the 1250 square foot area along the 50-foot separation wall. At present four bench molders, and two floor molders work directly against this wall. There is sufficient room to accommodate four more molders easily. Aluminum castings are stored for delivery in the northwest corner of the building near double swinging doors which open onto a driveway.

Two benches and two squeezers are located near the windows on the brass side, at the north end of the building in a space of approximately 200 square feet. Three brass melting furnaces operate with No. 45 crucibles. A cantilever type hoist supported on an overhead I-beam is used for lifting the 135-pound capacity crucibles out of the furnaces into the pouring shank. Set part way in a floor pit, the furnaces are gas fired and equipped with gas blowers and ratio valves.

Smoke and fumes are removed by 36-inch fans mounted in the wall just below a large hood. The furnace section is closed off on each side by hood to floor panels of sheet metal.

Equipment in the cleaning department includes an air hammer for removing cores, a band-saw for cutting aluminum and some brass gates, a sprue cutter, a sandblasting machine and tumbling mill for cleaning castings, and wheels for rough grinding.

The office is located next to the main entrance and is equipped throughout with metal desks, cabinets and other office furniture.

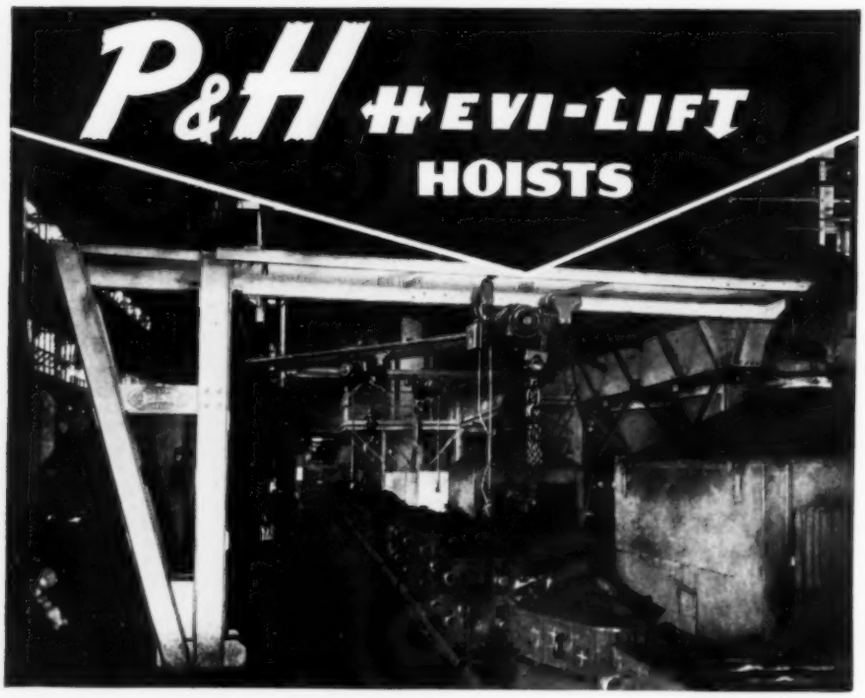
In line with best safety practices for transporting and handling sand and castings, the floor of the building is smoothly finished concrete. Plenty of room is provided in every department and the wide aisles that separate departments are marked clearly on the floor with wide white lines. There are no overhead wires or pipes leading into the building. Steam lines, telephone and electric wires, and compressed air and water pipes are brought to buildings through a 3 x 6-foot tunnel which connects all plants of the company underground. Gas is also piped into the building underground but not through the tunnel.

Book Review

Patent Fundamentals, by Adelbert Schapp, 176 pages, 5½ x 8½ inches, published by the Industrial Press, New York. $2.00.

This is a textbook for inventors, executives and students which explains in nontechnical language and demonstrates by practical examples the underlying principles of true invention, procedure in obtaining patent protection, drafting effective claims, making assignments, issuing licenses, and, how to protect both invention and inventor.

The treatise includes information on trademarks and copyrights, design patents, prints and labels, and illustrates the different conditions under which these protective measures become available.



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MELTING NONFERROUS METALS

(*Continued from page 37*)

nace, second, the condition of the furnace and furnace lining, and third, the adjustment of air and fuel to produce complete combustion. If it is a gas or oil furnace, the condition of the orifice through which the flame enters and the condition of the exit through which the gases escape are important. Obviously if all of the fuel is burned the highest possible temperature for the amount of fuel is available.

The highest possible temperature for the available fuel should result in maximum melting speed, which in turn should insure minimum length of time for bringing the metal to the desired molten temperature. With furnace conditions at their best, maximum efficiency is secured from the combustion of the fuel and the metal is exposed to the furnace gases for the minimum length of time because they were melted at the maximum speed. Good melting demands this maximum speed of melting and the absence of influences of any type that causes the gases to be mixed improperly. Improperly mixed gases in the furnace obviously will result in some of the gases being underburned and consequently, soluble in the heated metal.

Superheat Not Necessary

The second precaution, referring to not superheating the metal, is based on the fact that the foundryman starts with ingot metals plus possibly some gates or risers, the result of a previous alloying process. Therefore, there is no need to superheat to have complete mixture or chemical union. The only need for melting under these circumstances is to produce a sufficiently fluid material to fill the mold satisfactorily and maintain a sufficient temperature in the mold to insure fluidity during the entire filling of the mold and further fluidity in the riser even after the casting approximately has become set. It is very undesirable to superheat nonferrous metals beyond the absolute necessity. Additional increase in temperature means an additional time during which the metal is exposed to furnace gases and an increase in the sensitivity of the metal to these gases. The higher temperature to which the metal is raised the more it will dissolve the soluble gases available. Under the most ideal conditions in any type of furnace there is a possibility of some of the gases being insufficiently oxidized and thus being soluble in the heated metal. Superheating of some of the compositions regularly made in nonferrous foundries also is undesirable. It means an undue vaporization of component elements and consequently, means the loss of some expensive metals that must be replaced by making the necessary additions to bring the composition back to the desired formula.

In making different compositions, that is, alloying of the different elements to produce the desired ingot metals, the melting practice is quite different from that described for melting ingots to the desired temperature for pouring castings.

Raw materials have a wide variation in melting point and the solubility of the elements in one another is something that should be understood thoroughly if the best results are to be obtained. If the raw material consists of scrap or borings, or both, as is usual in the processes carried on by the ingot metal manufacturers, the melting process should be done on a mass production basis in a furnace capable of holding large quantities of metal. To get a high grade alloy from the melting of scrap, obviously a large amount must be melted in a furnace. Samples are taken from this large bath and checked for the

They must be good...

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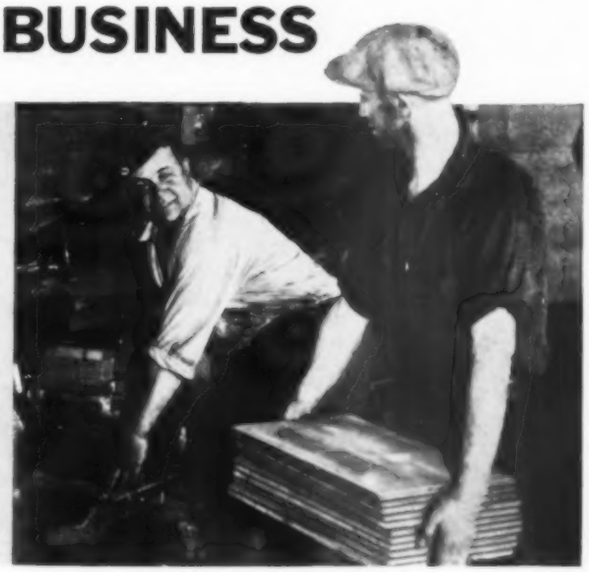

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composition by competent chemical analysts. The necessary new metal additions are made to the bath to bring the average composition of the entire bath to the desired composition. Furthermore, in melting such metals on a large scale in a big furnace, metal that is finely divided, such as borings grindings, etc., can be plunged beneath the surface where they are immmediately dissolved without undue vaporization or oxidation of the surface that is usual when borings are melted in small quantities and without the adequate bath in which to plunge them for complete submersion. That is a necessary feature.

A further value in melting scrap in large quantities is that minor impurities become average throughout a large mass of metal, so that the percentage becomes negligible. Where one piece of scrap containing objectionable impurities is added unintentionally to a small bath made in the usual small foundry furnace, the percentage of this objectionable impurity becomes disastrous and ruins the entire bath. If this metal has been poured into molds, all the castings are subject to rejection, with a consequent excessive loss which is costly.

From the foregoing it is apparent that the ingot metal manufacturer has a great advantage in using a large furnace having a capacity of several thousand pounds per melt. The ingot metal produced, even though it is made from scrap, may be of such a high quality as to be entirely satisfactory for most of the castings produced in the modern nonferrous foundry.

However, if the foundryman wishes to make his alloys from new metals a series of raw materials of different elements in the form of a very pure grade is available. During recent years the purity of the different raw materials has been brought to such a high degree that accuracy of control of the composition is much more simple.

Certain definite rules must be observed in the production of the different compositions when using these pure raw materials. The usual practice is to charge the furnace, first with the elements that require the highest temperature and then add the other elements in the order of their melting point. This is simply a general rule and is not always strictly observed. Frequently the element that melts at the highest temperature is added first. Additional elements that are readily soluble therein as it melts are added with it so that as the two reach their melting points they dissolve one another, resulting in the melting of the two elements at a little lower temperature than would be required for the melting of the element that had the maximum melting point.

Reduce First Oxides

Another fundamental rule is to be sure that dissolved oxides in the first elements to be melted have been reduced by the addition of deoxidizers before adding other elements that would react with these oxides to form new oxides that would rise to the surface and be skimmed off. This causes definite melting loss, which must be compensated for by adding additional quantities of the metal thus lost, if the resulting composition is to be up to formula.

Since all metals regularly used in nonferrous foundries are sensitive to furnace gases, care must be observed to expose them to soluble gases as little as possible. Since they absorb these gases even before they become molten, no metal should be in a position where it is in the direct path of the flow of the furnace gases any more than is absolutely unavoidable. A good way to correct this is to make certain that there is a minimum amount of underburned gases in the furnace. Thus any flow of gases over the heated metal will be insoluble rather than the soluble type.

Copper is one of the most sensi-

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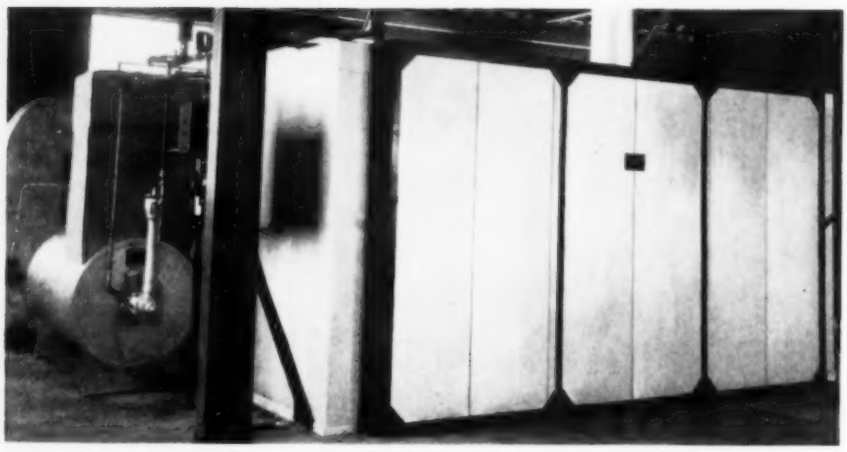

Typical CARL-MAYER Recirculating Gas Fired Mold Oven with Lift Door

Typical CARL-MAYER CUSTOMERS ...

Aluminum Co. of America
American Radiator Co.
Bucyrus-Erie Co.
Cadillac Motor Co.
Electric Autolite Co.
Ford Motor Co.
Fremont Foundry Co.
General Motors Corp.
Gilbert & Barker Co.
Harrison Radiator Corp.
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IMPORTANT FEATURES

1. Savings 25 to 50% over brick ovens.
2. Uniformity of baking only achievable with a recirculating air heater system such as designed and built by Carl-Mayer.
3. Lift doors with ball bearing lifting mechanism make raising and lowering a simple smooth operation.
4. Ruggedness typical of Carl-Mayer design.
5. Appearance, beautiful and trim, as well as ready for heavy duty.

CORE AND MOLD OVENS—ALL TYPES

Over 20 Years' Experience

The CARL-MAYER Corp.
3030 Euclid Ave., CLEVELAND, OHIO.

tive of the elements regularly melted. Consequently to expose this metal even at a red heat before it becomes molten, to currents of underburned gases, is a sure source of the absorbing of these gases, which will be released later when the metal is poured. Sound castings can be made only from sound metal, and sound metal results from good melting practice.

The procedure of melting each of the great variety of different compositions regularly produced in a modern foundry is to melt according to a definite plan. This plan should be laid down by competent metallurgists who have had the necessary experience to understand the several factors that influence the result from the charge in rotation of melting, or other conditions during the process. It is difficult here to lay down rules for each of the different compositions, since there are so many. With the copper base alloys containing copper and tin plus lead or zinc, or both, it is usual to melt the copper first, and if zinc is needed, add part of the zinc to the copper with the intention that that part of the zinc will deoxidize the copper so that when the remainder of the elements are added, the copper will be relatively free from oxides. Consequently, a good alloy will result. Only an experienced metallurgist can determine the requisite amount of zinc to compensate for that consumed in the deoxidizing process and lost in the vaporization during the alloying process.

Divide Phosphorus Addition

If phosphorus is to be used in the composition, as for example in the copper base composition with tin or tin and lead, it is better practice to add some of the phosphorus in the form of phosphor copper or phosphor tin to the copper before other elements are added, and then add the remainder of the phosphor copper or phosphor tin after all the other elements have been well stirred in.

In copper base alloys containing silicon, obviously the copper is melted first and then the hardening alloy is added, producing what is known as a silicon bronze. Here the metallurgist also is necessary to make the necessary calculations to determine the ratio of the hardening alloy to copper to insure the correct ratio of the component elements in the resulting composition.

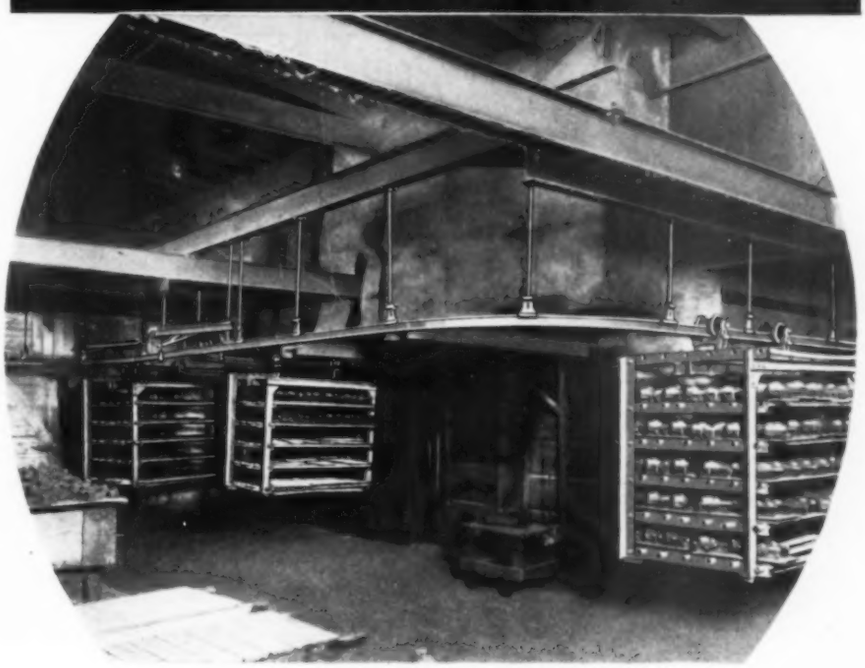
In the aluminum bronzes, it is usual to melt the copper first with the iron, to which is added some of the aluminum. The remainder of the aluminum is added as soon as the first part of the charge is sufficiently molten to absorb it. It will be seen that the first aluminum acts as a reducing agent in deoxidizing the copper. A competent metallurgist must be available to insure the proper ratio of the component elements—copper, aluminum and iron, so that the resulting composition will conform to that desired.

Where no metallurgist is available the foundryman will do well to use the ingot metals produced by the ingot metal manufacturer. He has that metallurgical assistance to insure uniformity of analysis and freedom from the presence of undesirable impurities, and to insure the absence of dissolved gases that may give trouble in the later production of castings. In the production of ingot metals by the foundryman, the question of the type of furnace equipment available, and whether the metals are to be melted in a crucible or an open hearth have a definite bearing on the proper practice. Proper practice for each different type of furnace will be covered in a further article.

South Bend Lathe Works, South Bend, Ind., has just issued a 10-page mimeographed bulletin entitled, "Planning the Industrial Apprentice Training Shop," which shows some floor plans with equipment required, and gives information on methods of organizing the shop work.

HANDLE DELICATE CORES OVERHEAD

— the smooth Tramrail way



Delicate cores are easily handled from the core makers, through ovens to molding floor on Cleveland Tramrail core rack carriers without danger of breakage.

The construction of the carrier wheels permits the racks to be pushed directly into the core oven without damage to either wheels or bearings.

Cleveland Tramrail carriers are easy to push. Only an effort of 15 lbs. for starting and 10 lbs. for running is required per ton of weight.

A nearby representative will be glad to discuss how Cleveland Tramrail can be used profitably in your foundry.

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CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT
Other products: CLEVELAND CRANES and STEELWELD MACHINERY

CASTINGS MUST PASS MANY TESTS

(*Concluded from page* 33)

with excessive pressure there is a possibility of ruining perfectly good castings.

Another relatively simple and yet valuable method of exploring is employed where normal visual inspection shows a slight imperfection or a very small gas hole. A small wire inserted in this hole may reveal a large cavity. Where this condition is found it is advisable to cut up at least one casting for thorough examination.

Water testing is applied to castings containing water, oil, gas or air chambers. This type of inspection usually is limited to relatively small castings, but it has proved effective in locating various types of holes or cracks in large castings. Water under pressure is applied to the apparent or suspected surface.

Where the water test cannot be applied oil or some suitable substitute can be spread over one surface. After a period of 5 to 15 minutes, the oil will work itself through the casting.

Use Simple Fixtures

Strained and warped castings, are detected by normal visual inspection, aided by simple checking fixtures including the ordinary straightedge and flat surface. Other simple checking fixtures can be developed for use with spherical or warped surfaces.

An experienced inspector can set up a casting on the surface table or inspection plate and prove whether or not certain errors have crept in since originally it was checked as a sample.

In some instances it becomes necessary to develop combination layout and grinding fixtures. Either the surface of the casting, or layout pads, are properly ground so that the castings may be placed in similar machining fixtures where the locating points on machine shop fixtures register against the pads or surfaces previously ground in the foundry. This is a very costly method and should be resorted to only when consistent locating spots on the casting cannot be obtained.

The ordinary file test is applied to malleable iron improperly annealed, chilled surfaces or edges on cast iron, welded steel castings that have not been properly annealed.

Naturally, it is impractical to go over each casting 100 per cent with a file. This method is used largely where experience indicates that a certain type of casting may be hard in a particular location. The file test also tends to bring to light cracks, as well as chills and hard spots.

Operators and supervisors may contend that a particular casting is too hard. This statement may be true when the casting is compared with a previous lot. The casting in reality may not be too hard but may be just exceptionally tough. If this casting can be machined, even with reduced feeds and speeds on the particular machine, or even grinding instead of turning, it may be practical to use it from a standpoint of being satisfactory for its application. Usually it is necessary to inspect these castings by a hardness testing machine.

Study Rejected Castings

The X-ray is one of the most specialized types of inspection. Application of X-ray in the foundry is so varied that any reference or description should be left to a specialist in this field.

Foundries may obtain valuable information from careful inspection of all castings rejected by the machine shop. Too much emphasis cannot be placed on this phase of inspection. Too often defective castings returned from the machine shop to the foundry as scrap are put back into the various cupolas and furnaces, without any study or analysis. Defective castings carry a tremendous amount of information which should be utilized toward the improvement of subsequent castings by the foundry organization.

Considering uniformity of inspection standards, we have to picture three arrangements. In the first a company makes a number of castings and buys them outside. A second foundry makes castings for many different industries. In a third instance a manufacturing company makes all its own castings.

Uniformity of inspection may be obtained in the last case, where control centers entirely under one management. In the second instance, the foundry should conform to the standard of the most critical buyer rather than establish different standards for different customers. The most unsatisfactory arrangement would be to adopt the standard of the least critical buyer as the standard for the foundry as a whole. In the case indicated first, it is absolutely essential that an equal standard of inspection be maintained. We do not want to penalize some outside foundry with standards that are more critical than those established for our own foundry. We do not want to penalize our own foundry by establishing standards above those expected from outside foundries.

To solve this problem of uniform standards, the company must establish some form of employe training. Caterpillar Tractor Co. has developed one of the finest systems of educating employes in this respect at the three Peoria plants, foundry, road machinery and tractor plant. Inspection is all in one organization. Inspectors and inspection supervisors constantly are changed from one location to another. Many machine shop and assembly inspectors in the road machinery and tractor plants originally started as inspectors in the foundry. Every inspector doing layout work in the foundry is an outstanding inspector who has had line inspection work and layout work in the tractor and road machinery plants. In this manner the same standard of inspection is maintained throughout the entire plants.

Hold Group Meetings

The inspection division conducts semiannual group meetings of all inspectors where the machine shop inspectors become more familiar with the foundry inspectors' problems and vice versa. The educational program has expanded to include trips of the foundry and road machinery inspectors through the tractor plant, road machinery and tractor inspectors through the foundry, and naturally, foundry and tractor inspectors through the road machinery plant. The training program includes a 4-year apprentice training, 2-year apprentice training, and 2-year engineering graduate training, and foremen's conferences for manufacturing supervisors.

Last, but probably most important of all, the Caterpillar Tractor Co. endeavors to acquaint each employe with the machinery practices of other departments in various ways. He is given an opportunity to become familiar with Caterpillar products, and is shown how his workmanship affects the quality of the finished product, the success of his company, and his own future.

From a paper presented before the Northeastern Ohio Chapter, A.F.A. Cleveland, March 14. The author, M. D. Johnson is chief of the inspection department, Caterpiller Tractor Co., Peoria, Ill.

Simplified practice recommendation R79-28, "Malleable Foundry Refractories," has been reaffirmed without change according to the division of simplified practice, bureau of standards, Washington. It establishes shapes and sizes of various kinds of malleable foundry refractories.

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"Cleanblast" alloys are patented.

Cleanblast Shot and Grit are proven quality products made in many grades to satisfy your needs:

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Grit produced in 14 sizes.

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Our engineers will gladly review your blast cleaning operations and make recommendations for further economies.

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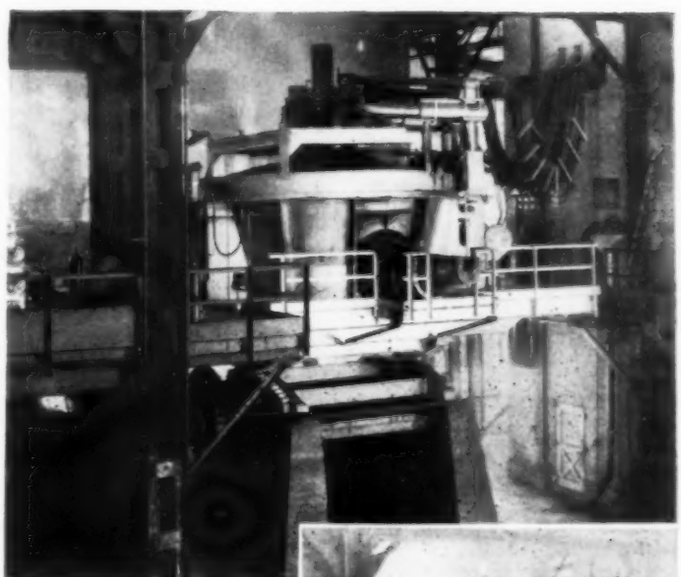

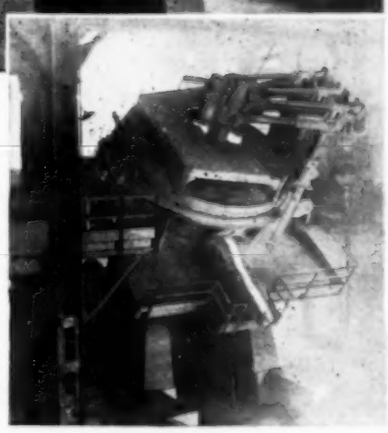

Illustrated is a recent installation of a 25-ton Heroult Furnace with many special features. It is an all-welded unit equipped with 18-inch electrodes. The platform is attached to the shell — tilts when pouring. The shell is flared from floor level to roof — materially increasing scrap capacity.

Heroult

ELECTRIC FURNACES

AMERICAN BRIDGE Heroult Electric Furnaces now embody novel and distinctive features—the result of constant striving to perfect the most modern and economical tool for efficient melting and refining of iron and steel for castings, high grade alloy, tool and stainless steels.

Dependent on size and operating requirements they are adaptable to hand, chute, machine or drop-bottom bucket charging. Capacity ratings range from ½ to 100 tons.

Why not avail yourself of the specialized experience of our furnace engineers for your specific requirements.

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UNITED STATES STEEL

CONTROL MOISTURE OF CUPOLA AIR

(*Concluded from page* 39)

Kathene being the trade name of the lithium chloride solution.

The standard regenerator contains a circulating pump that circulates the solution through the entire system, a sump for holding the solution charge, a density controller, a contact surface to contact a small stream of outside air with the solution being regenerated, and a small fan to move this air through the regenerator. A small amount of solution is continuously bled off the main stream, passed through the heater and down over the contactor surface in the regenerator, thence back into the sump. When this solution is heated and comes in contact with a small stream of outside air, the air will remove moisture from the solution.

Controls Solution Strength

The density controller in the regenerator is a simple hydrometer type control that operates a steam valve on the heater and the regenerator fan as a means of keeping the solution in the sump at the same strength. That is to say, it governs the operation of the regenerator so that the amount of moisture being removed from the solution is always equal to the amount of moisture being added to the solution in the contactor cells. Since the regenerator operates only as the solution tends to become diluted, the heat energy used by the system is directly proportional to the moisture removal all the way from full load down to no load. For example with air entering the contactor cells at 6½ grains per cubic foot, the heat energy used by the system would be only about 50 per cent of the heat energy required to reduce 10 grain air down to 3 grains per cubic foot. This is very desirable in cupola dry blast systems because they operate at full load only a small percentage of the total time. Hence, steam is not wasted.

As the solution removes moisture from the air in the contactor cells, it tends to become warm. To compensate for this, a cooler using water is necessary. It is the control of water flow through this cooler that governs the finely modulated control of moisture content in the air going to the cupola. A controller in the air stream measuring moisture content operates the water regulating valve on this cooler so that the solution temperature entering the contactor cells is just what is necessary to produce 3 grain air.

Since at constant strength a low temperature solution will remove more moisture from the air than a higher temperature solution, the moisture controller operates as follows: As the moisture content of the outside air drops below 10 grains per cubic foot, the controller will start to throttle the water flow through the cooler so as to raise the solution temperature entering the contactor cells. A subsequent increase in moisture content of outside air causes the controller to open the water valve and lower the solution temperature.

The heating coil shown on the diagram is designed to raise the cupola air to a constant dry bulb temperature of 110 degrees regardless of the air temperature leaving the contactor cells. A combination dry and wet bulb recorder inserted in the air stream just downstream from this heating coil would show two perfect lines, one representing a dry bulb temperature of 110 degrees and the other a wet bulb temperature of 69 degrees. The combination of these two temperature conditions corresponds exactly with 3 grains of moisture per cubic foot.

Most cupola operators will find, as we have found, that it is quite desirable to maintain the cupola air at a constant condition of 3 grains per cubic foot regardless of outside conditions. In other words, when the air drops below 3 grains per cubic foot on the outside it is, in the interest of uniformity, advantageous to boost it back up again to 3 grains per cubic foot.

Temperature Is Adjusted

A second heater, in series with the cooler, is all that is necessary to accomplish this year round constant control. If the moisture content of the air going to the cupola still tends to drop below 3 grains per cubic foot, with the water completely shut off the cooler, the moisture controller then opens a steam valve on the second heater (not shown on the diagram). The solution going to the contactor cells then will be heated to the point where it will start to give up moisture to the cupola air in just the right amount to bring the moisture content back up to 3 grains per cubic foot. The density controller in the regenerator, working in the reverse direction, then operates a makeup water valve in the sump so as to hold the solution strength constant regardless of how much water is being evaporated by the cupola air.

Summarizing the operation of this system, consider the regenerator and its heater as working independently of the moisture control apparatus located in the cupola air stream. They merely function to maintain the solution strength absolutely constant regardless of what is going on elsewhere. If they were cut off from the rest of the system and several gallons of water were poured into the sump, the regenerator automatically would go into operation to drive that moisture off bringing the solution back to its predetermined strength. The control of moisture in the cupola air is governed entirely by the opening and closing of the regulating valve on either the solution heater or the solution cooler under direct and automatic regulation of the moisture controller located in the cupola air stream.

This equipment has not been in operation a sufficient length of time to ascertain accurately the cost of maintenance, but due to the simplicity of the system coupled with the absence of complicated moving parts it is expected that it will not be unreasonably high.

Since the apparatus uses low pressure steam as the heat energy source and since it uses this steam only in direct proportion to the amount of moisture being removed, operating costs are not prohibitive. Where low pressure steam is not available the year round these systems are designed to operate on gas.

The fact that foundrymen are becoming increasingly aware of the ill effects of varying moisture content of cupola air is evident through papers and discussions before the A. F. A.

This system in operation at our plant has been functioning perfectly during periods where moisture was added to the cupola air as well as when moisture was being removed, maintaining the moisture content constantly at 3 grains per cubic foot. Further advantages of this equipment are its compact size, simplicity of operation, low operating and maintenance cost as well as relatively low initial cost.

Book Review

Dictionary of Metals and Their Alloys, by F. J. Camm, fabrikoid, 245 pages, 5½ x 8½ inches, published by Chemical Publishing Co., New York; $3.

Arranged in alphabetical form, this volume contains descriptions of a large number of metals and alloys, and in many cases supplies data on compositions and on characteristics. The book also contains short chapters on heat treatment of tool steels, practical hints on hardening and tempering, spraying metallic coatings, rustproofing iron and steel, electroplating, polishing and finishing metal, chemical coloring of metals, hardness test, and an appendix with numerous tables.